



FCC PART 15.247 TEST REPORT

For

Shenzhen KingBoard Technology Co., Ltd.

Bldg. A, Dakanglong Industry Zone Dabuxiang, Guanlan, Shenzhen, China

FCC ID: SXXKTS-856

Report Type: Original Report	Product Name: Bluetooth Speaker
Test Engineer: <i>Kevin Hu</i> <u>Kevin Hu</u>	
Report Number: <u>RDG161228806</u>	
Report Date: <u>2017-01-21</u>	
Reviewed By: Henry Ding EMC Leader	<i>Henry Ding</i>
Test Laboratory: Bay Area Compliance Laboratories Corp. (Chengdu) 5040, HuiLongWan Plaza, No. 1, ShaWan Road, JinNiu District, ChengDu, China Tel: 028-65523123, Fax: 028-65525125 www.baclcorp.com	

Note: This test report was prepared for the customer shown above and for the device described herein. It may not be duplicated or used in part without prior written consent from Bay Area Compliance Laboratories Corp. (Chengdu). Any unauthorized alteration, forgery or falsification of the content or appearance of this document is unlawful and offenders may be prosecuted to the fullest extent of the law. This report was valid only with a valid digital signature.

TABLE OF CONTENTS

GENERAL INFORMATION	4
PRODUCT DESCRIPTION FOR EQUIPMENT UNDER TEST (EUT)	4
OBJECTIVE	4
RELATED SUBMITTAL(S)/GRANT(S)	4
TEST METHODOLOGY	4
TEST FACILITY	5
SYSTEM TEST CONFIGURATION	6
DESCRIPTION OF TEST CONFIGURATION	6
EUT EXERCISE SOFTWARE	6
EQUIPMENT MODIFICATIONS	6
SUPPORT EQUIPMENT LIST AND DETAILS	6
EXTERNAL CABLE	6
BLOCK DIAGRAM OF TEST SETUP	7
SUMMARY OF TEST RESULTS	8
FCC §15.247 (i) & §1.1310 & §2.1093- RF EXPOSURE	9
APPLICABLE STANDARD	9
FCC §15.203 - ANTENNA REQUIREMENT	10
APPLICABLE STANDARD	10
ANTENNA CONNECTOR CONSTRUCTION	10
FCC §15.207 (a) – AC LINE CONDUCTED EMISSIONS	11
APPLICABLE STANDARD	11
MEASUREMENT UNCERTAINTY	11
EUT SETUP	12
EMI TEST RECEIVER SETUP	12
TEST PROCEDURE	12
CORRECTED AMPLITUDE & MARGIN CALCULATION	13
TEST EQUIPMENT LIST AND DETAILS	13
TEST DATA	13
FCC §15.209, §15.205 & §15.247(d) - SPURIOUS EMISSIONS	16
APPLICABLE STANDARD	16
MEASUREMENT UNCERTAINTY	16
EUT SETUP	17
EMI TEST RECEIVER & SPECTRUM ANALYZER SETUP	18
TEST PROCEDURE	18
TEST EQUIPMENT LIST AND DETAILS	18
CORRECTED AMPLITUDE & MARGIN CALCULATION	19
TEST DATA	19
FCC §15.247(a) (1) - CHANNEL SEPARATION TEST	22
APPLICABLE STANDARD	22
TEST EQUIPMENT LIST AND DETAILS	22
TEST PROCEDURE	22
TEST DATA	22
FCC §15.247(a) (1) – 20 dB BANDWIDTH TESTING	27
APPLICABLE STANDARD	27
TEST PROCEDURE	27

TEST EQUIPMENT LIST AND DETAILS	27
TEST DATA	27
FCC §15.247(a) (1) (iii) - QUANTITY OF HOPPING CHANNEL TEST	32
APPLICABLE STANDARD	32
TEST PROCEDURE	32
TEST EQUIPMENT LIST AND DETAILS	32
TEST DATA	32
FCC §15.247(a) (1) (iii) - TIME OF OCCUPANCY (DWELL TIME)	35
APPLICABLE STANDARD	35
TEST PROCEDURE	35
TEST EQUIPMENT LIST AND DETAILS	35
TEST DATA	35
FCC §15.247(b) (1) - PEAK OUTPUT POWER MEASUREMENT	46
APPLICABLE STANDARD	46
TEST PROCEDURE	46
TEST EQUIPMENT LIST AND DETAILS	46
TEST DATA	46
FCC §15.247(d) - BAND EDGES TESTING	51
APPLICABLE STANDARD	51
TEST PROCEDURE	51
TEST EQUIPMENT LIST AND DETAILS	51
TEST DATA	52

GENERAL INFORMATION

Product Description for Equipment under Test (EUT)

The **Shenzhen KingBoard Technology Co., Ltd.** 's product, model number: **KTS-856 (FCC ID: SXXKTS-856)** (the "EUT") in this report was a **Bluetooth Speaker**, which was measured approximately: 31.0 cm (L) x 22.5 cm (W) x 22.5 cm (H), rated input voltage: DC3.7V from battery.

**All measurement and test data in this report was gathered from final production sample, serial number: 161228806 (assigned by the BAACL, Chengdu). It may have deviation from any other sample. The EUT supplied by the applicant was received on 2016-12-30, and EUT conformed to test requirement.*

Objective

This report is prepared on behalf of **Shenzhen KingBoard Technology Co., Ltd.** in accordance with Part 2, Subpart J, Part 15, Subparts A, B and C of the Federal Communications Commission's rules

The tests were performed in order to determine the Bluetooth BDR and EDR mode of EUT compliance with FCC Part 15, Subpart C, and section 15.203, 15.205, 15.207, 15.209 and 15.247 rules.

Related Submittal(s)/Grant(s)

N/A

Test Methodology

All measurements contained in this report were conducted with ANSI C63.10-2013, American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices.

All emissions measurement was performed and Bay Area Compliance Laboratories Corp. (Chengdu). The radiated testing was performed at an antenna-to-EUT distance of 3 meters.

The uncertainty of any RF tests which use conducted method measurement is ± 3.17 dB, the uncertainty of any radiation on emissions measurement is:

30M~200MHz: ± 4.7 dB;
200M~1GHz: ± 6.0 dB;
1G~6GHz: ± 5.13 dB;
6G~25GHz: ± 5.47 dB;

And the uncertainty will not be taken into consideration for all test data recorded in the report.

Test Facility

The test site used by BACL to collect test data is located in the 5040, HuiLongWan Plaza, No. 1, ShaWan Road, JinNiu District, ChengDu, China

Test site at BACL has been fully described in reports submitted to the Federal Communication Commission (FCC). The details of these reports have been found to be in compliance with the requirements of Section 2.948 of the FCC Rules on April 24, 2015. The facility also complies with the radiated and AC line conducted test site criteria set forth in ANSI C63.4-2014.

The Federal Communications Commission has the reports on file and is listed under FCC Registration No.: 560332. The test site has been approved by the FCC for public use and is listed in the FCC Public Access Link (PAL) database.

SYSTEM TEST CONFIGURATION

Description of Test Configuration

The system was configured for testing in engineering mode.

The device only support Bluetooth BDR(GFSK) and EDR($\pi/4$ -DQPSK) mode, EDR(8DPSK) can't support.

EUT Exercise Software

The software ' FCCAssit 1.5' was used during testing, the system configured maximum output power as default setting. The software is only for changing channel and modes.

Equipment Modifications

No modification was made to the EUT.

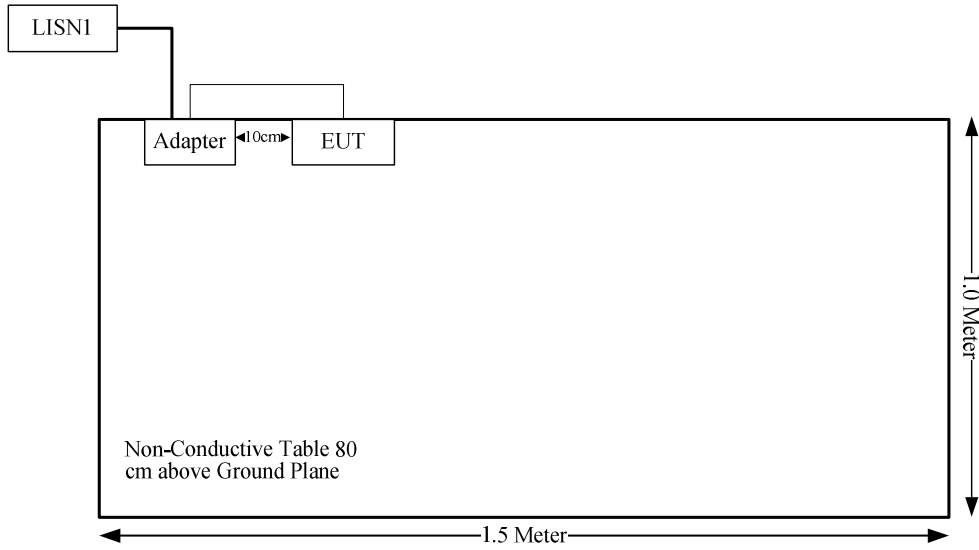
Support Equipment List and Details

Manufacturer	Description	Model	Serial Number
Huntkey	Adapter	HKA01105021	0D1603003303

External Cable

Cable Description	Shielding Type	Ferrite Core	Length (m)	From Port	To
USB Cable	Yes	No	0.85	USB Port of Adapter	EUT

Block Diagram of Test Setup



SUMMARY OF TEST RESULTS

FCC Rules	Description of Test	Result
FCC §15.247 (i) & §1.1310 & §2.1093	RF Exposure	Compliance
§15.203	Antenna Requirement	Compliance
§15.207 (a)	Conducted Emissions	Compliance
§15.205, §15.209, §15.247(d)	Spurious Emissions	Compliance
§15.247 (a)(1)	20 dB Bandwidth	Compliance
§15.247(a)(1)	Channel Separation Test	Compliance
§15.247(a)(1)(iii)	Time of Occupancy (Dwell Time)	Compliance
§15.247(a)(1)(iii)	Quantity of hopping channel Test	Compliance
§15.247(b)(1)	Peak Output Power Measurement	Compliance
§15.247(d)	Band Edges	Compliance

FCC §15.247 (i) & §1.1310 & §2.1093- RF EXPOSURE

Applicable Standard

According to §15.247(i) and §1.1310, systems operating under the provisions of this section shall be operated in a manner that ensure that the public is not exposed to radio frequency energy level in excess of the Commission's guideline.

According to KDB447498 D01 General RF Exposure Guidance v06

The 1-g and 10-g SAR test exclusion thresholds for 100 MHz to 6 GHz at test separation distances ≤ 50 mm are determined by:

$[(\text{max. power of channel, including tune-up tolerance, mW}) / (\text{min. test separation distance, mm})] \cdot [\sqrt{f(\text{GHz})}] \leq 3.0$ for 1-g SAR and ≤ 7.5 for 10-g extremity SAR, where

- $f(\text{GHz})$ is the RF channel transmit frequency in GHz
- Power and distance are rounded to the nearest mW and mm before calculation
- The result is rounded to one decimal place for comparison
- 3.0 and 7.5 are referred to as the numeric thresholds in the step 2 below

The test exclusions are applicable only when the minimum test separation distance is ≤ 50 mm and for transmission frequencies between 100 MHz and 6 GHz. When the minimum test separation distance is < 5 mm, a distance of 5 mm according to 5) in section 4.1 is applied to determine SAR test exclusion.

Measurement Result

The maximum tune-up power including tolerance is -8.0 dBm(0.16mW).

$[(\text{max. power of channel, mW}) / (\text{min. test separation distance, mm})][\sqrt{f(\text{GHz})}]$
 $= 0.16/5 \cdot (\sqrt{2.480}) = 0.1 < 3.0$

So the SAR evaluation is not necessary.

FCC §15.203 - ANTENNA REQUIREMENT

Applicable Standard

According to FCC § 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this Section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited.

Antenna Connector Construction

The EUT has one internal antenna arrangement for buletooth and the antenna gain is 3.0 dBi, fulfill the requirement of this section. Please refer to the EUT photos.

Result: Compliance.

FCC §15.207 (a) – AC LINE CONDUCTED EMISSIONS

Applicable Standard

FCC§15.207

Measurement Uncertainty

Compliance or non-compliance with a disturbance limit shall be determined in the following manner:

If U_{lab} is less than or equal to U_{cispr} of Table 1, then:

- compliance is deemed to occur if no measured disturbance level exceeds the disturbance limit;
- non-compliance is deemed to occur if any measured disturbance level exceeds the disturbance limit.

If U_{lab} is greater than U_{cispr} of Table 1, then:

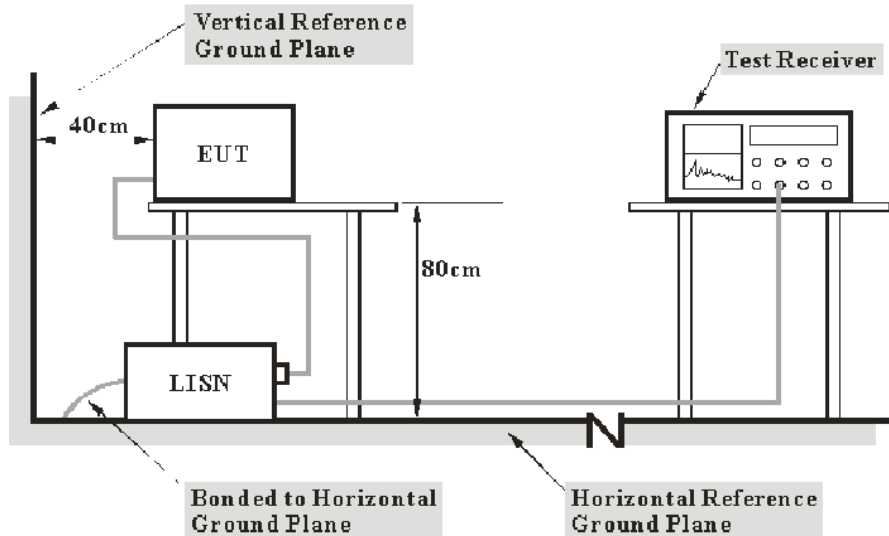
- compliance is deemed to occur if no measured disturbance level, increased by $(U_{lab} - U_{cispr})$, exceeds the disturbance limit;
- non-compliance is deemed to occur if any measured disturbance level, increased by $(U_{lab} - U_{cispr})$, exceeds the disturbance limit.

Based on CISPR 16-4-2:2011, measurement uncertainty of conducted disturbance at mains port using AMN at Bay Area Compliance Laboratories Corp. (Chengdu) is ± 3.17 dB (150 kHz to 30 MHz).

Table 1 – Values of U_{cispr}

Measurement	U_{cispr}
Conducted disturbance at mains port using AMN (150 kHz to 30 MHz)	3.4 dB

EUT Setup



- Note: 1. Support units were connected to second LISN.
2. Both of LISNs (AMN) 80 cm from EUT and at the least 30 cm from other units and other metal planes support units.

The setup of EUT is according with per ANSI C63.10-2013 measurement procedure. The specification used was with the FCC Part 15.207 limits.

The spacing between the peripherals was 10 cm.

The adapter was connected to a 120 V/60 Hz AC power source.

EMI Test Receiver Setup

The EMI test receiver was set to investigate the spectrum from 150 kHz to 30 MHz.

During the conducted emission test, the EMI test receiver was set with the following configurations:

Frequency Range	IF B/W
150 kHz – 30 MHz	9 kHz

Test Procedure

During the conducted emission test, the adapter was connected to the outlet of the first LISN.

Maximizing procedure was performed on the six (6) highest emissions of the EUT.

All data was recorded in the Quasi-peak and average detection mode.

Corrected Amplitude & Margin Calculation

The basic equation is as follows:

$$V_C = V_R + A_C + VDF$$

Herein,

V_C : corrected voltage amplitude

V_R : reading voltage amplitude

A_C : attenuation caused by cable loss

VDF: voltage division factor of AMN or ISN

The “**Margin**” column of the following data tables indicates the degree of compliance within the applicable limit. For example, a margin of 7dB means the emission is 7dB below the maximum limit. The equation for margin calculation is as follows:

$$\text{Margin} = \text{Limit} - \text{Corrected Amplitude}$$

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Rohde & Schwarz	EMI Test Receiver	ESCS 30	836858/0016	2016-12-02	2017-12-01
Rohde & Schwarz	PULSE LIMITER	ESH3Z2	357.8810.52	2016-10-31	2017-10-30
Rohde & Schwarz	L.I.S.N.	ENV216	3560.6550.06	2016-12-02	2017-12-01
N/A	Conducted Cable	NO.5	N/A	2016-11-10	2017-11-09
N/A	Coaxial Cable	1.8m	N/A	2016-05-06	2017-05-05
R&S	Test Software	EMC32	Version8.53.0	N/A	N/A

* **Statement of Traceability:** BA CL (Chengdu) attested that all calibrations have been performed, traceable to National Primary Standards and International System of Units (SI).

Test Data

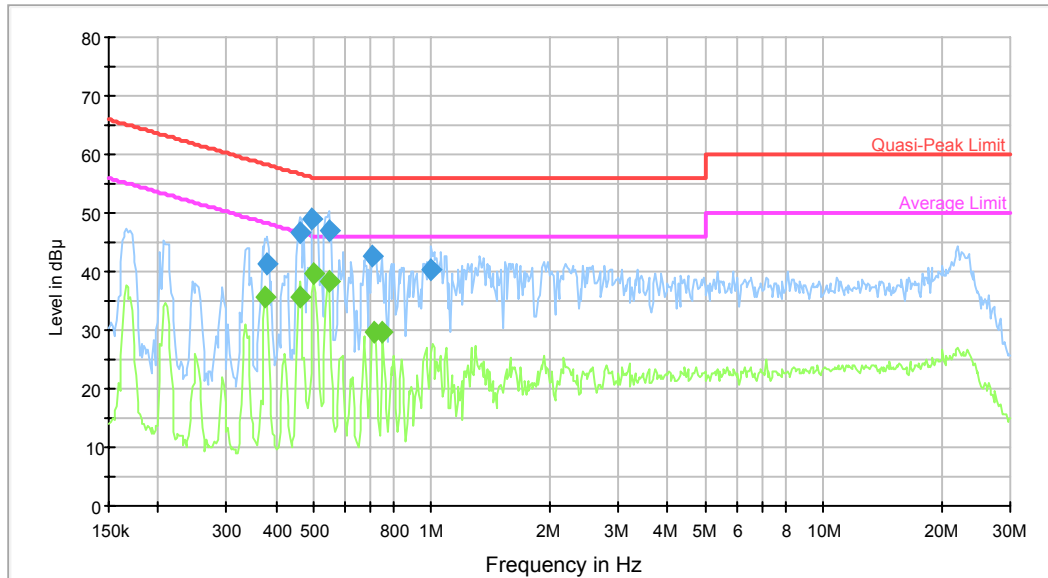
Environmental Conditions

Temperature:	25.6 °C
Relative Humidity:	48 %
ATM Pressure:	98.9 kPa

The testing was performed by Kevin Hu on 2017-01-05.

Test Mode: Transmitting

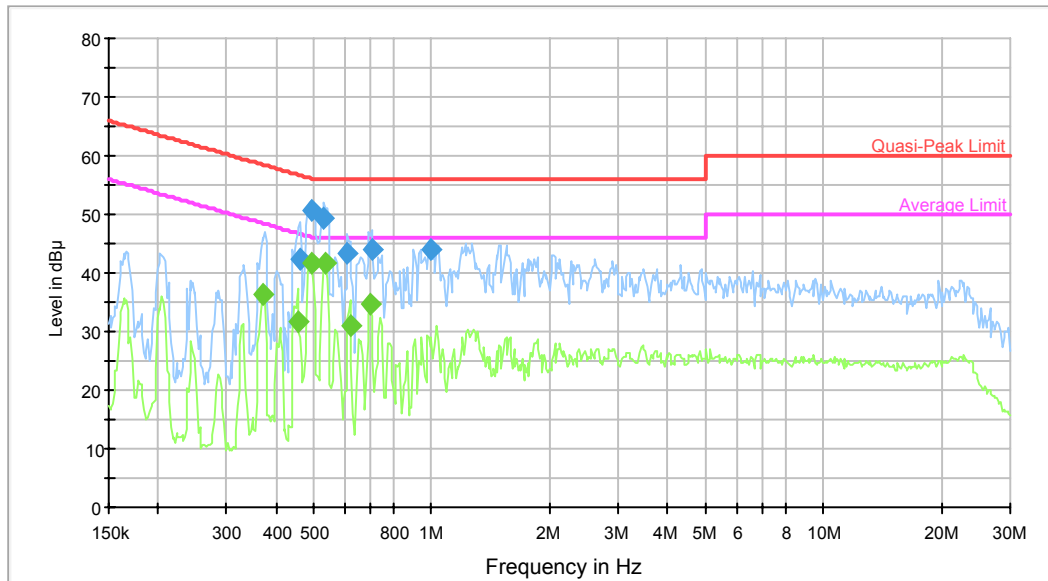
AC120 V, 60 Hz, Line:



Frequency (MHz)	QuasiPeak (dBµV)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)	Comment
0.381043	41.4	9.000	L1	19.8	16.9	58.3	Compliance
0.461346	46.6	9.000	L1	19.7	10.1	56.7	Compliance
0.495646	49.1	9.000	L1	19.7	7.0	56.1	Compliance
0.545378	47.0	9.000	L1	19.7	9.0	56.0	Compliance
0.703777	42.6	9.000	L1	19.7	13.4	56.0	Compliance
0.999305	40.2	9.000	L1	19.7	15.8	56.0	Compliance

Frequency (MHz)	Average (dBµV)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)	Comment
0.375019	35.6	9.000	L1	19.8	12.8	48.4	Compliance
0.461346	35.8	9.000	L1	19.7	10.9	46.7	Compliance
0.499611	39.6	9.000	L1	19.7	6.4	46.0	Compliance
0.545378	38.3	9.000	L1	19.7	7.7	46.0	Compliance
0.715082	29.6	9.000	L1	19.7	16.4	46.0	Compliance
0.750100	29.7	9.000	L1	19.7	16.3	46.0	Compliance

AC120 V, 60 Hz, Neutral:



Frequency (MHz)	QuasiPeak (dBµV)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)	Comment
0.461346	42.3	9.000	N	19.6	14.4	56.7	Compliance
0.491712	50.6	9.000	N	19.6	5.5	56.1	Compliance
0.532496	49.5	9.000	N	19.6	6.5	56.0	Compliance
0.609741	43.3	9.000	N	19.6	12.7	56.0	Compliance
0.703777	44.1	9.000	N	19.6	11.9	56.0	Compliance
0.991374	44.2	9.000	N	19.7	11.8	56.0	Compliance

Frequency (MHz)	Average (dBµV)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)	Comment
0.369089	36.4	9.000	N	19.6	12.1	48.5	Compliance
0.454052	31.7	9.000	N	19.6	15.1	46.8	Compliance
0.491712	41.6	9.000	N	19.6	4.5	46.1	Compliance
0.536756	41.5	9.000	N	19.6	4.5	46.0	Compliance
0.619536	31.2	9.000	N	19.6	14.8	46.0	Compliance
0.698191	34.8	9.000	N	19.6	11.2	46.0	Compliance

FCC §15.209, §15.205 & §15.247(d) - SPURIOUS EMISSIONS

Applicable Standard

FCC §15.247 (d); §15.209; §15.205;

Measurement Uncertainty

Compliance or non-compliance with a disturbance limit shall be determined in the following manner:

If U_{lab} is less than or equal to U_{cispr} of Table 2, then:

–compliance is deemed to occur if no measured disturbance level exceeds the disturbance limit;
–non-compliance is deemed to occur if any measured disturbance level exceeds the disturbance limit.

If U_{lab} is greater than U_{cispr} of Table 2, then:

–compliance is deemed to occur if no measured disturbance level, increased by $(U_{lab} - U_{cispr})$, exceeds the disturbance limit;
–non-compliance is deemed to occur if any measured disturbance level, increased by $(U_{lab} - U_{cispr})$, exceeds the disturbance limit.

Based on CISPR 16-4-2-2011, measurement uncertainty of radiated emission at a distance of 3m at Bay Area Compliance Laboratories Corp. (Chengdu) is:

30M~200MHz: ±4.7 dB;

200M~1GHz: ±6.0 dB;

1G~6GHz: ±5.13dB;

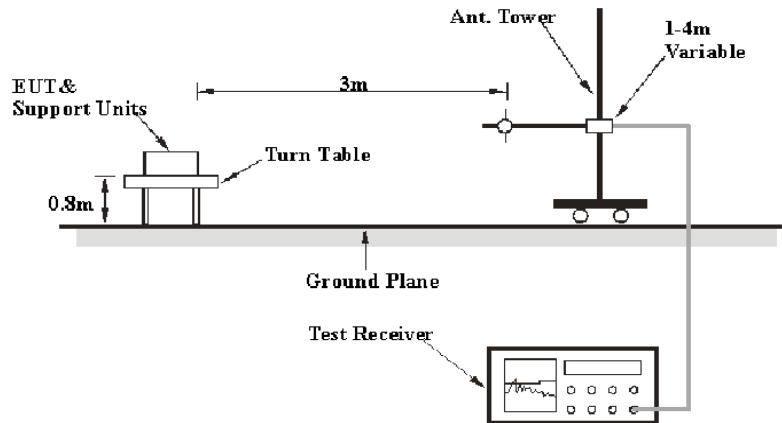
6G~25GHz: ±5.47 dB;

Table 2 – Values of U_{cispr}

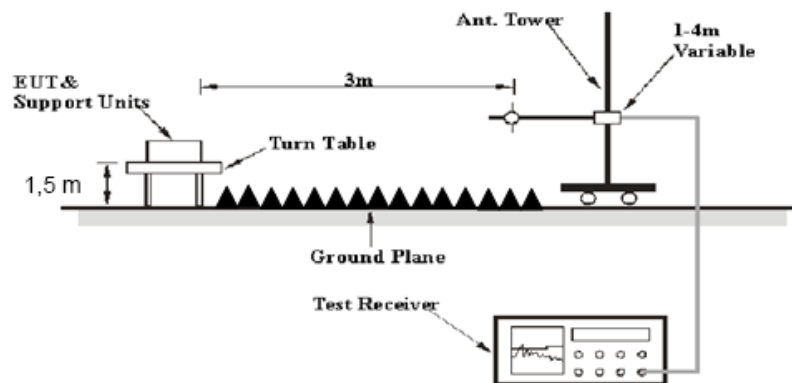
Measurement	U_{cispr}
Radiated disturbance (electric field strength at an OATS or in a SAC) (30 MHz to 1000 MHz)	6.3 dB
Radiated disturbance (electric field strength in a FAR) (1 GHz to 6 GHz)	5.2 dB
Radiated disturbance (electric field strength in a FAR) (6 GHz to 18 GHz)	5.5 dB

EUT Setup

Below 1GHz:



Above 1GHz:



The radiated emission tests were performed in the 3 meters test site, using the setup accordance with the ANSI C63.10-2013. The specification used was the FCC 15.209, and FCC 15.247 limits.

The external I/O cables were draped along the test table and formed a bundle 30 to 40 cm long in the middle.

The spacing between the peripherals was 10 cm.

EMI Test Receiver & Spectrum Analyzer Setup

The system was investigated from 30 MHz to 25 GHz.

During the radiated emission test, the EMI test receiver & Spectrum Analyzer Setup were set with the following configurations:

Frequency Range	RBW	Video B/W	IF B/W	Detector
30 MHz – 1000 MHz	120 kHz	300 kHz	120 kHz	QP
Above 1 GHz	1MHz	3 MHz	/	PK
	1MHz	10 Hz	/	AV

Test Procedure

Maximizing procedure was performed on the highest emissions to ensure that the EUT complied with all installation combinations.

Data was recorded in Quasi-peak detection mode for frequency range of 30 MHz - 1 GHz, peak and average detection modes for frequencies above 1 GHz.

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Agilent	Amplifier	8447D	2944A10442	2016-12-02	2017-12-01
Rohde & Schwarz	EMI Test Receiver	ESCI	100028	2016-12-02	2017-12-01
Sunol Sciences	Broadband Antenna	JB3	A101808	2016-04-10	2019-04-09
Rohde & Schwarz	Spectrum Analyzer	FSEM30	100018	2016-12-02	2017-12-01
ETS	Horn Antenna	3115	003-6076	2016-12-02	2017-12-01
Ducommun Technologies	Horn Antenna	ARH-4223-02	1007726-0113024	2014-06-16	2017-06-15
Mini-circuits	Amplifier	ZVA-183-S+	771001215	2016-05-20	2017-05-19
HP	Amplifier	8449B	3008A00277	2016-12-02	2017-12-01
EMCT	Semi-Anechoic Chamber	966	N/A	2015-04-24	2018-04-23
N/A	RF Cable (below 1GHz)	NO.1	N/A	2016-11-10	2017-11-09
N/A	RF Cable (below 1GHz)	NO.4	N/A	2016-11-10	2017-11-09
N/A	RF Cable (above 1GHz)	NO.2	N/A	2016-11-10	2017-11-09

* **Statement of Traceability:** BA CL (Chengdu) attested that all calibrations have been performed, traceable to National Primary Standards and International System of Units (SI).

Corrected Amplitude & Margin Calculation

The Corrected Amplitude is calculated by adding the Antenna Factor and Cable Loss, and subtracting the Amplifier Gain from the Meter Reading. The basic equation is as follows:

$$\text{Corrected Amplitude} = \text{Meter Reading} + \text{Antenna Factor} + \text{Cable Loss} - \text{Amplifier Gain}$$

The “**Margin**” column of the following data tables indicates the degree of compliance with the applicable limit. For example, a margin of 7dB means the emission is 7dB below the limit. The equation for margin calculation is as follows:

$$\text{Margin} = \text{Limit} - \text{Corrected Amplitude}$$

Test Data

Environmental Conditions

Temperature:	23.6~23.7 °C
Relative Humidity:	48~52 %
ATM Pressure:	95.6~98.9 kPa

* The testing was performed by Kevin Hu from 2017-01-05 to 2017-01-09.

Test Mode: Transmitting

30MHz to 25 GHz:

BDR Mode (GFSK):

Frequency (MHz)	Receiver		Rx Antenna		Cable loss (dB)	Amplifier Gain (dB)	Corrected Amplitude (dBµV/m)	FCC 15.247	
	Reading (dBµV)	Detector (PK/QP/AV)	Polar (H/V)	Factor (dB)				Limit (dBµV/m)	Margin (dB)
Low Channel: 2402 MHz									
2402	54.94	PK	H	23.53	3.00	0.00	81.47	N/A	N/A
2402	44.10	AV	H	23.53	3.00	0.00	70.63	N/A	N/A
2402	60.43	PK	V	23.53	3.00	0.00	86.96	N/A	N/A
2402	49.58	AV	V	23.53	3.00	0.00	76.11	N/A	N/A
2390	28.14	PK	V	23.57	3.00	0.00	54.71	74	19.29
2390	15.64	AV	V	23.57	3.00	0.00	42.21	54	11.79
4804	32.38	PK	V	30.77	5.12	26.87	41.4	74	32.6
4804	19.70	AV	V	30.77	5.12	26.87	28.72	54	25.28
7206	34.28	PK	V	34.71	6.16	26.35	48.8	74	25.2
7206	23.92	AV	V	34.71	6.16	26.35	38.44	54	15.56
3187	40.76	PK	V	25.25	3.71	26.48	43.24	74	30.76
3187	27.67	AV	V	25.25	3.71	26.48	30.15	54	23.85
512.09	43.83	QP	H	18.22	1.64	28.82	34.87	46.00	11.13
640.13	38.39	QP	H	20.14	1.92	28.85	31.60	46.00	14.40
Middle Channel: 2441 MHz									
2441	59.70	PK	H	23.40	3.00	0.00	86.1	N/A	N/A
2441	48.76	AV	H	23.40	3.00	0.00	75.16	N/A	N/A
2441	61.17	PK	V	23.40	3.00	0.00	87.57	N/A	N/A
2441	50.42	AV	V	23.40	3.00	0.00	76.82	N/A	N/A
4882	33.45	PK	V	31.02	5.09	26.87	42.69	74	31.31
4882	22.03	AV	V	31.02	5.09	26.87	31.27	54	22.73
7323	33.75	PK	V	34.95	6.22	26.40	48.52	74	25.48
7323	23.31	AV	V	34.95	6.22	26.40	38.08	54	15.92
3196	37.99	PK	V	25.30	3.72	26.48	40.53	74	33.47
3196	24.90	AV	V	25.30	3.72	26.48	27.44	54	26.56
3120	37.74	PK	V	24.87	3.61	26.45	39.77	74	34.23
3120	23.26	AV	V	24.87	3.61	26.45	25.29	54	28.71
512.09	44.1	QP	H	18.22	1.64	28.82	35.14	46.00	10.86
640.13	38.53	QP	H	20.14	1.92	28.85	31.74	46.00	14.26
High Channel: 2480 MHz									
2480	59.38	PK	H	23.27	2.99	0.00	85.64	N/A	N/A
2480	48.68	AV	H	23.27	2.99	0.00	74.94	N/A	N/A
2480	60.10	PK	V	23.27	2.99	0.00	86.36	N/A	N/A
2480	48.70	AV	V	23.27	2.99	0.00	74.96	N/A	N/A
2483.5	29.36	PK	V	23.26	2.99	0.00	55.61	74	18.39
2483.5	16.83	AV	V	23.26	2.99	0.00	43.08	54	10.92
4960	32.72	PK	V	31.27	5.05	26.88	42.16	74	31.84
4960	21.86	AV	V	31.27	5.05	26.88	31.3	54	22.7
7440	34.74	PK	V	35.18	6.27	26.45	49.74	74	24.26
7440	23.06	AV	V	35.18	6.27	26.45	38.06	54	15.94
3187	40.73	PK	V	25.25	3.71	26.48	43.21	74	30.79
3187	29.08	AV	V	25.25	3.71	26.48	31.56	54	22.44
512.09	44.94	QP	H	18.22	1.64	28.82	35.98	46.00	10.02
640.13	38.95	QP	H	20.14	1.92	28.85	32.16	46.00	13.84

EDR Mode ($\pi/4$ -DQPSK):

Frequency (MHz)	Receiver		Rx Antenna		Cable loss (dB)	Amplifier Gain (dB)	Corrected Amplitude (dB μ V/m)	FCC 15.247	
	Reading (dB μ V)	Detector (PK/QP/AV)	Polar (H/V)	Factor (dB)				Limit (dB μ V/m)	Margin (dB)
Low Channel: 2402 MHz									
2402	57.26	PK	H	23.53	3.00	0.00	83.79	N/A	N/A
2402	44.53	AV	H	23.53	3.00	0.00	71.06	N/A	N/A
2402	59.11	PK	V	23.53	3.00	0.00	85.64	N/A	N/A
2402	45.76	AV	V	23.53	3.00	0.00	72.29	N/A	N/A
2390	28.85	PK	V	23.57	3.00	0.00	55.42	74	18.58
2390	15.57	AV	V	23.57	3.00	0.00	42.14	54	11.86
4804	33.48	PK	V	30.77	5.12	26.87	42.5	74	31.5
4804	23.07	AV	V	30.77	5.12	26.87	32.09	54	21.91
7206	34.08	PK	V	34.71	6.16	26.35	48.6	74	25.4
7206	22.41	AV	V	34.71	6.16	26.35	36.93	54	17.07
2921	39.05	PK	V	24.04	3.36	26.49	39.96	74	34.04
2921	27.31	AV	V	24.04	3.36	26.49	28.22	54	25.78
512.09	44.47	QP	H	18.22	1.64	28.82	35.51	46.00	10.49
640.13	39.39	QP	H	20.14	1.92	28.85	32.60	46.00	13.40
Middle Channel: 2441 MHz									
2441	59.28	PK	H	23.40	3.00	0.00	85.68	N/A	N/A
2441	46.45	AV	H	23.40	3.00	0.00	72.85	N/A	N/A
2441	59.73	PK	V	23.40	3.00	0.00	86.13	N/A	N/A
2441	48.29	AV	V	23.40	3.00	0.00	74.69	N/A	N/A
4882	32.59	PK	V	31.02	5.09	26.87	41.83	74	32.17
4882	22.01	AV	V	31.02	5.09	26.87	31.25	54	22.75
7323	34.90	PK	V	34.95	6.22	26.40	49.67	74	24.33
7323	23.21	AV	V	34.95	6.22	26.40	37.98	54	16.02
3191	39.79	PK	V	25.27	3.72	26.48	42.3	74	31.7
3191	28.32	AV	V	25.27	3.72	26.48	30.83	54	23.17
2957	39.86	PK	V	24.11	3.39	26.45	40.91	74	33.09
2957	27.63	AV	V	24.11	3.39	26.45	28.68	54	25.32
512.09	44	QP	H	18.22	1.64	28.82	35.04	46.00	10.96
640.13	39.83	QP	H	20.14	1.92	28.85	33.04	46.00	12.96
High Channel: 2480 MHz									
2480	60.31	PK	H	23.27	2.99	0.00	86.57	N/A	N/A
2480	48.30	AV	H	23.27	2.99	0.00	74.56	N/A	N/A
2480	61.13	PK	V	23.27	2.99	0.00	87.39	N/A	N/A
2480	47.30	AV	V	23.27	2.99	0.00	73.56	N/A	N/A
2483.5	30.85	PK	V	23.26	2.99	0.00	57.1	74	16.9
2483.5	16.91	AV	V	23.26	2.99	0.00	43.16	54	10.84
4960	33.83	PK	V	31.27	5.05	26.88	43.27	74	30.73
4960	22.59	AV	V	31.27	5.05	26.88	32.03	54	21.97
7440	33.84	PK	V	35.18	6.27	26.45	48.84	74	25.16
7440	22.68	AV	V	35.18	6.27	26.45	37.68	54	16.32
3010	39.42	PK	V	24.26	3.45	26.41	40.72	74	33.28
3010	28.99	AV	V	24.26	3.45	26.41	30.29	54	23.71
512.09	44.94	QP	H	18.22	1.64	28.82	35.98	46.00	10.02
640.13	38.39	QP	H	20.14	1.92	28.85	31.60	46.00	14.40

FCC §15.247(a) (1) - CHANNEL SEPARATION TEST

Applicable Standard

Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20dB bandwidth of the hopping channel, whichever is greater. Alternatively, frequency hopping systems operating in the 2400-2483.50 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20dB bandwidth of the hopping channel, whichever is greater provided the systems operate with an output power no greater than 125 mW.

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Rohde & Schwarz	Signal Analyzer	FSIQ26	831929/005	2016-09-21	2017-09-20
N/A	RF Cable	N/A	N/A	Each Time	/

* **Statement of Traceability:** BACL (Chengdu) attested that all calibrations have been performed, traceable to National Primary Standards and International System of Units (SI).

Test Procedure

1. Set the EUT in transmitting mode, spectrum Bandwidth was set at 30 kHz, maxhold the channel.
2. Set the adjacent channel of the EUT maxhold another trace.
3. Measure the channel separation.

Test Data

Environmental Conditions

Temperature:	25.7 °C
Relative Humidity:	41 %
ATM Pressure:	95.6 kPa

* *The testing was performed by Kevin Hu on 2017-01-11.*

Test Result: Compliance.

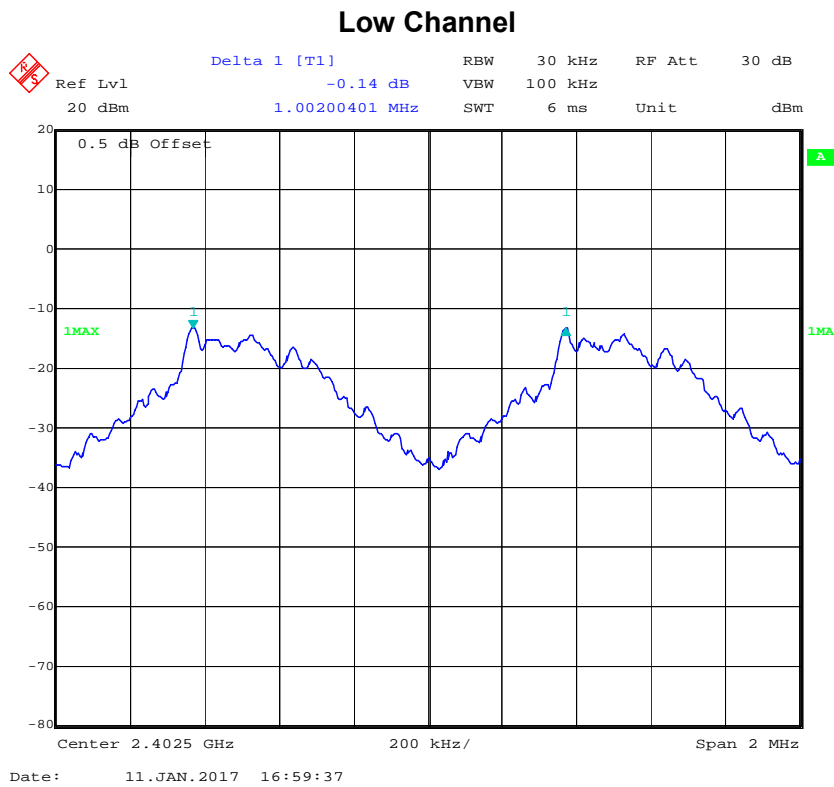
Please refer to following tables and plots

Test Mode: Transmitting

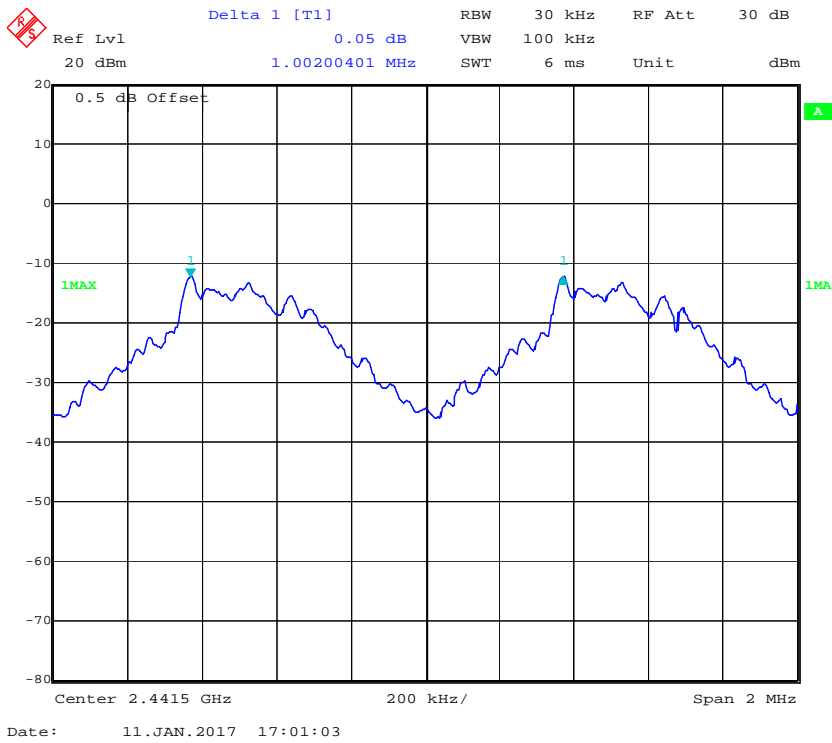
Mode	Channel	Frequency (MHz)	Channel Separation (MHz)	Limit (MHz)
BDR (GFSK)	Low	2402	1.002	0.567
	Middle	2441	1.002	0.567
	High	2480	1.002	0.567
EDR ($\pi/4$ -DQPSK)	Low	2402	1.006	0.820
	Middle	2441	1.002	0.820
	High	2480	1.002	0.820

Note: Limit= (2/3) × 20dB bandwidth

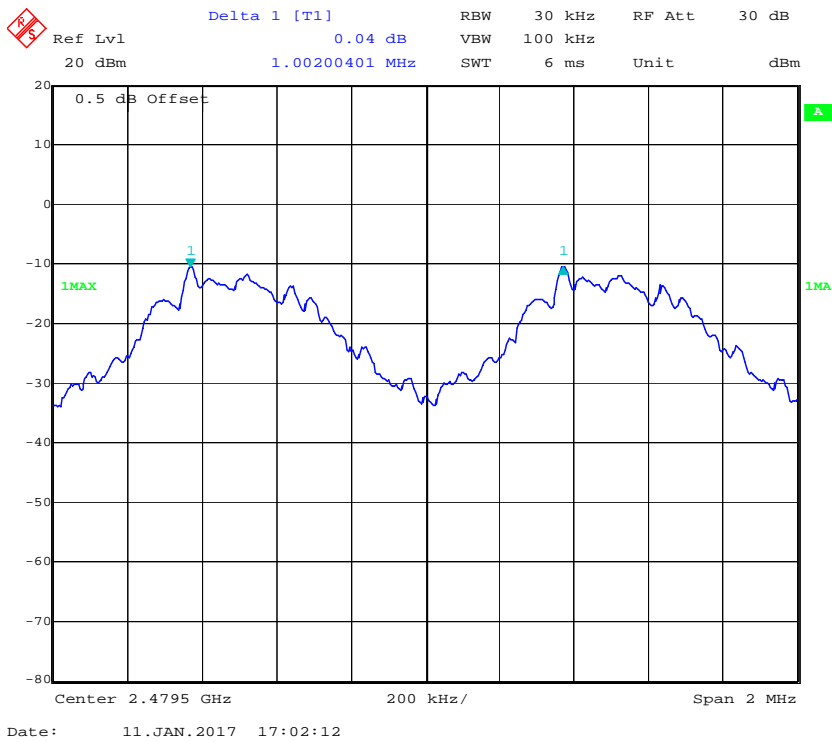
BDR Mode (GFSK):



Middle Channel

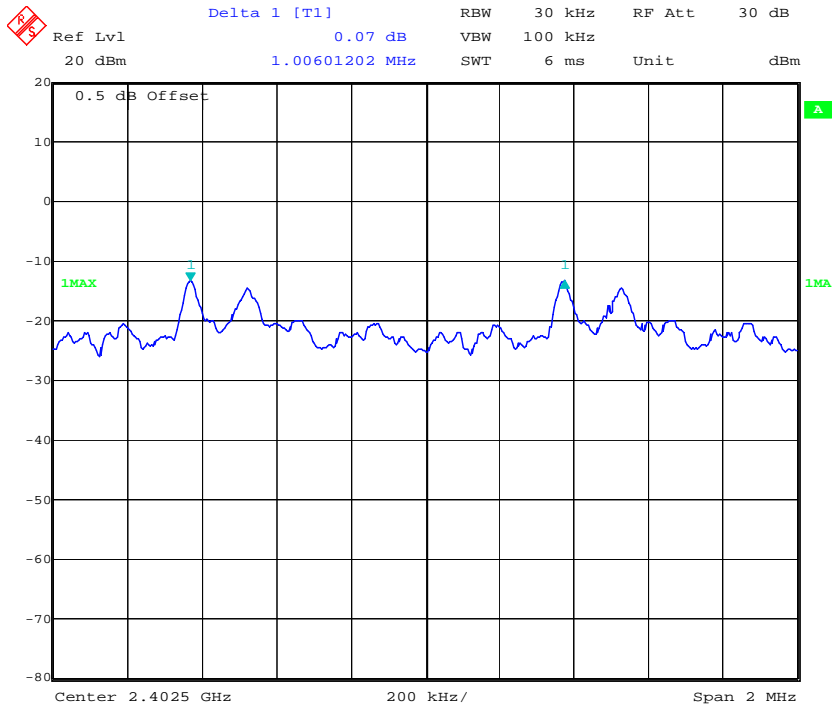


High Channel



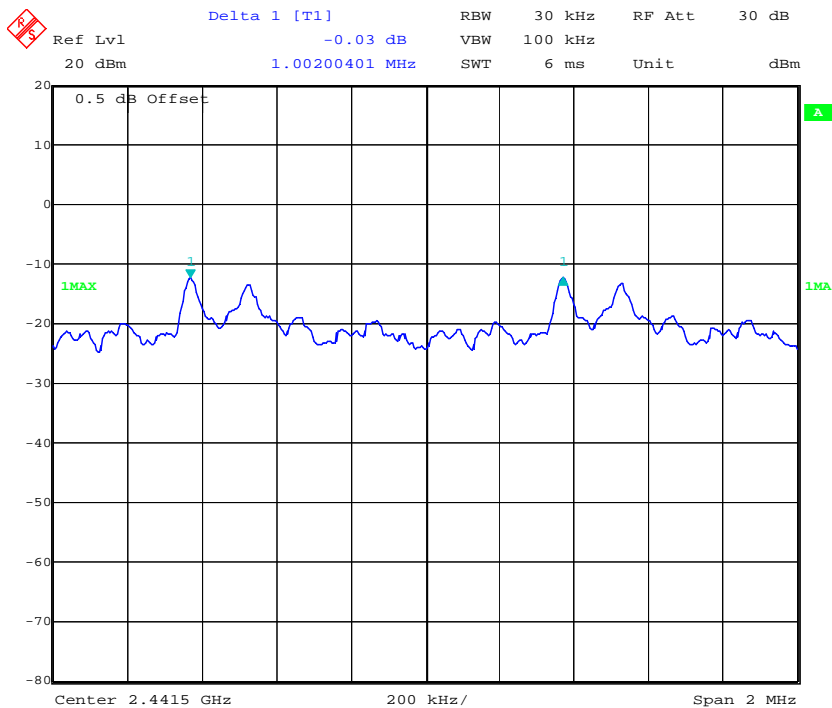
EDR Mode ($\pi/4$ -DQPSK):

Low Channel



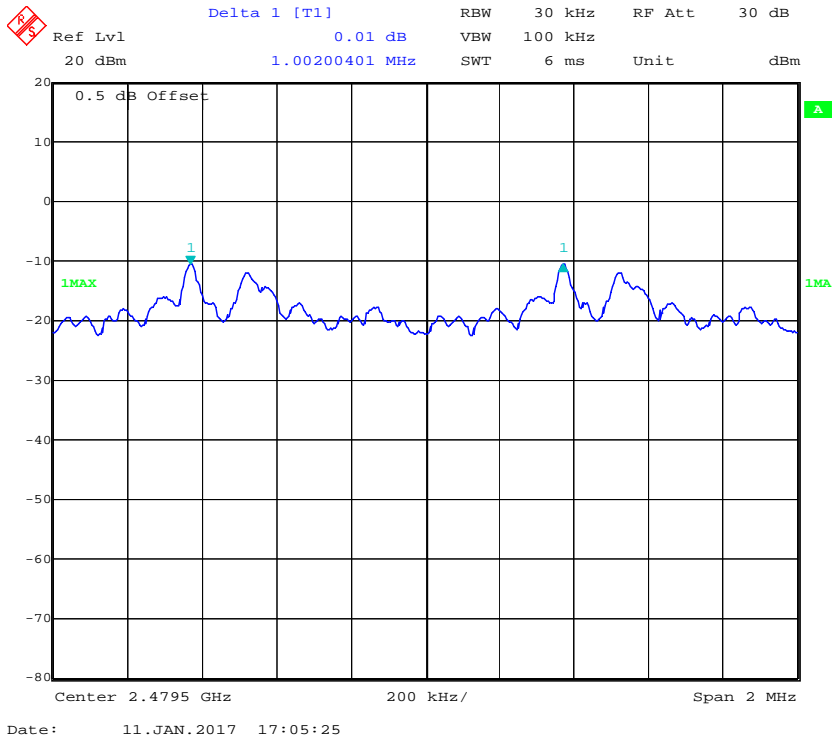
Date: 11.JAN.2017 17:03:12

Middle Channel



Date: 11.JAN.2017 17:04:16

High Channel



FCC §15.247(a) (1) – 20 dB BANDWIDTH TESTING

Applicable Standard

Alternatively, frequency hopping systems operating in the 2400–2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW.

Test Procedure

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Position the EUT on the test table without connection to measurement instrument. Turn on the EUT. Then set it to any one convenient frequency within its operating range. Set a reference level on the measuring instrument equal to the highest peak value.
3. Measure the frequency difference of two frequencies that were attenuated 20 dB from the reference level. Record the frequency difference as the emission bandwidth.
4. Repeat above procedures until all frequencies measured were complete.

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Rohde & Schwarz	Signal Analyzer	FSIQ26	831929/005	2016-09-21	2017-09-20
N/A	RF Cable	N/A	N/A	Each Time	/

* **Statement of Traceability:** BAAC (Chengdu) attested that all calibrations have been performed, traceable to National Primary Standards and International System of Units (SI).

Test Data

Environmental Conditions

Temperature:	25.7 °C
Relative Humidity:	41 %
ATM Pressure:	95.6 kPa

* *The testing was performed by Kevin Hu on 2017-01-11.*

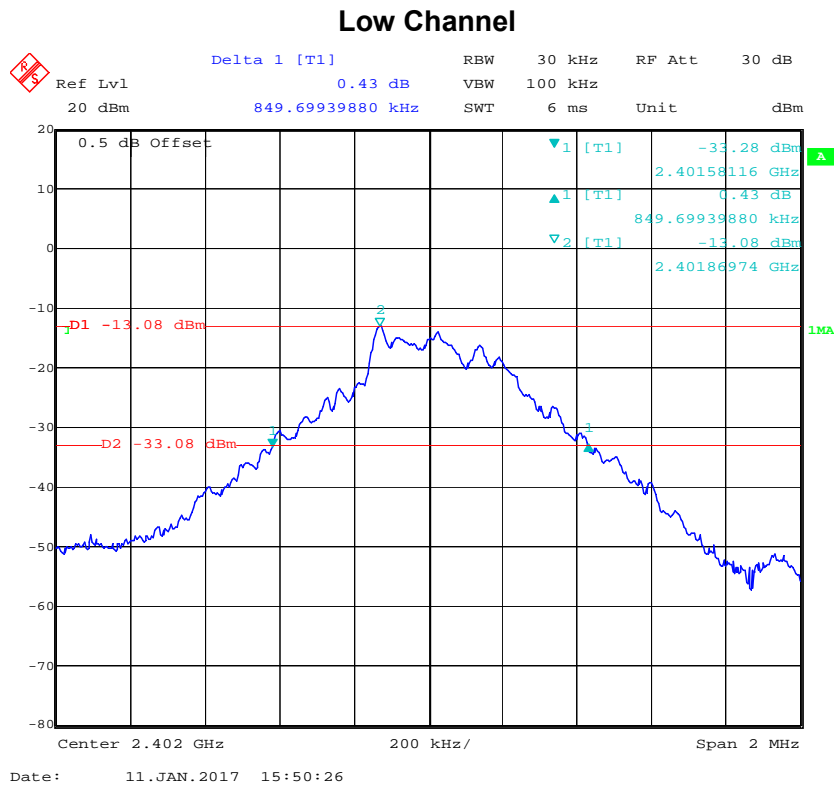
Test Result: Compliance.

Please refer to following tables and plots

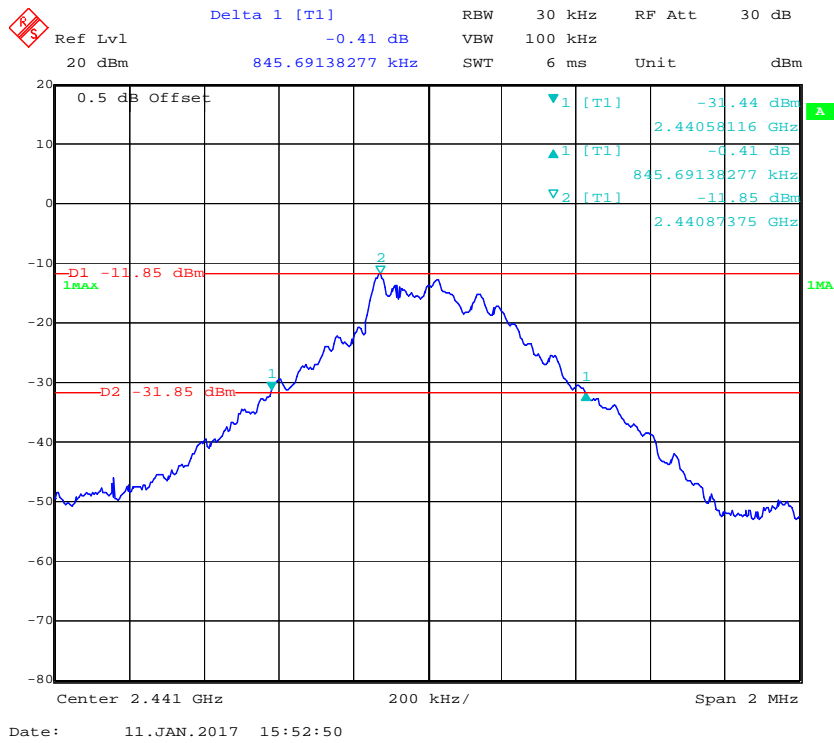
Test Mode: Transmitting

Mode	Channel	Frequency (MHz)	20 dB Bandwidth (MHz)
BDR Mode (GFSK)	Low	2402	0.85
	Middle	2441	0.85
	High	2480	0.85
EDR Mode ($\pi/4$ -DQPSK):	Low	2402	1.23
	Middle	2441	1.23
	High	2480	1.23

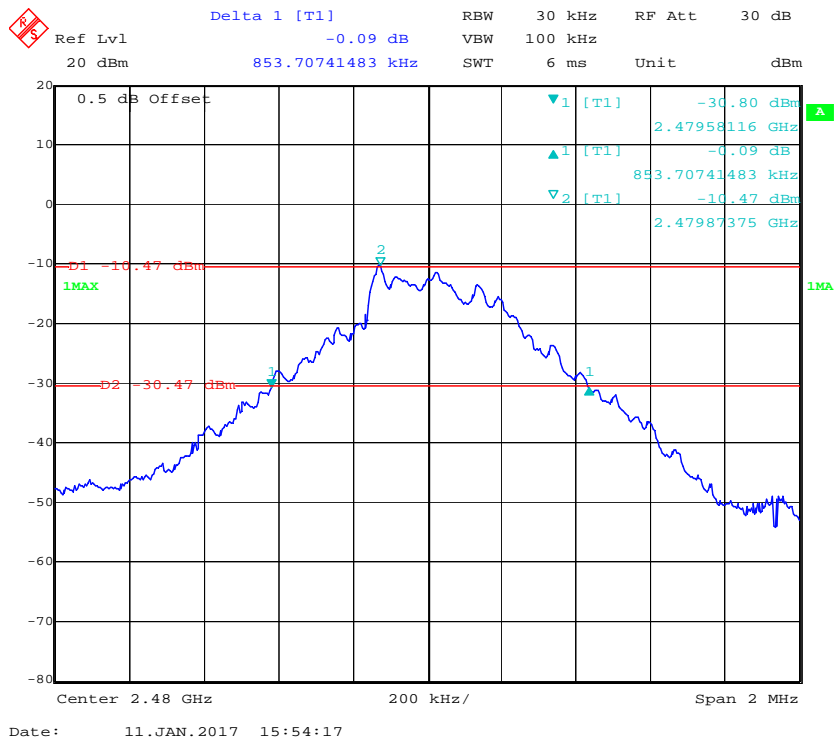
BDR Mode (GFSK):



Middle Channel

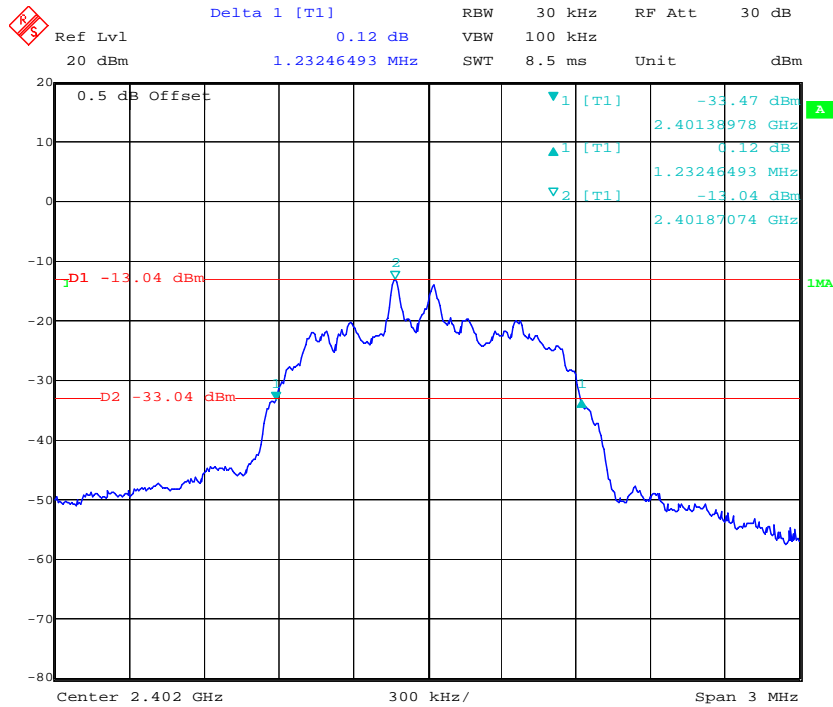


High Channel



EDR Mode ($\pi/4$ -DQPSK):

Low Channel



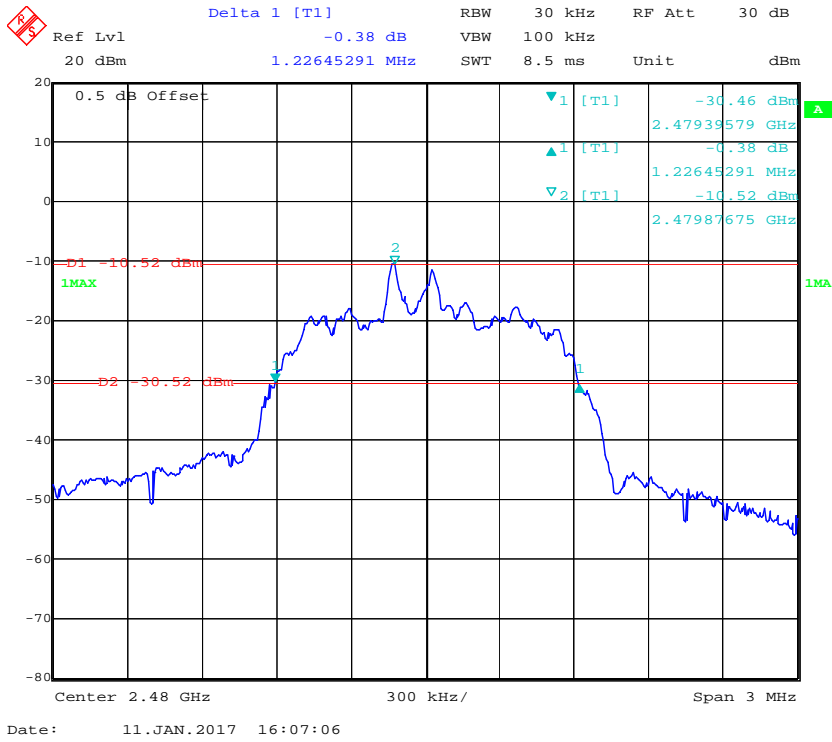
Date: 11.JAN.2017 16:03:52

Middle Channel



Date: 11.JAN.2017 16:05:45

High Channel



FCC §15.247(a) (1) (iii) - QUANTITY OF HOPPING CHANNEL TEST

Applicable Standard

Frequency hopping systems in the 2400–2483.5 MHz band shall use at least 15 channels. The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed. Frequency hopping systems may avoid or suppress transmissions on a particular hopping frequency provided that a minimum of 15 channels are used.

Test Procedure

1. Check the calibration of the measuring instrument (SA) using either an internal calibrator or a known signal from an external generator.
2. Set the EUT in hopping mode from first channel to last.
3. By using the Max-Hold function record the Quantity of the channel.

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Rohde & Schwarz	Signal Analyzer	FSIQ26	831929/005	2016-09-21	2017-09-20
N/A	RF Cable	N/A	N/A	Each Time	/

* **Statement of Traceability:** BACL (Chengdu) attested that all calibrations have been performed, traceable to National Primary Standards and International System of Units (SI).

Test Data

Environmental Conditions

Temperature:	25.7 °C
Relative Humidity:	41 %
ATM Pressure:	95.6 kPa

* *The testing was performed by Kevin Hu on 2017-01-11.*

Test Result: Compliance.

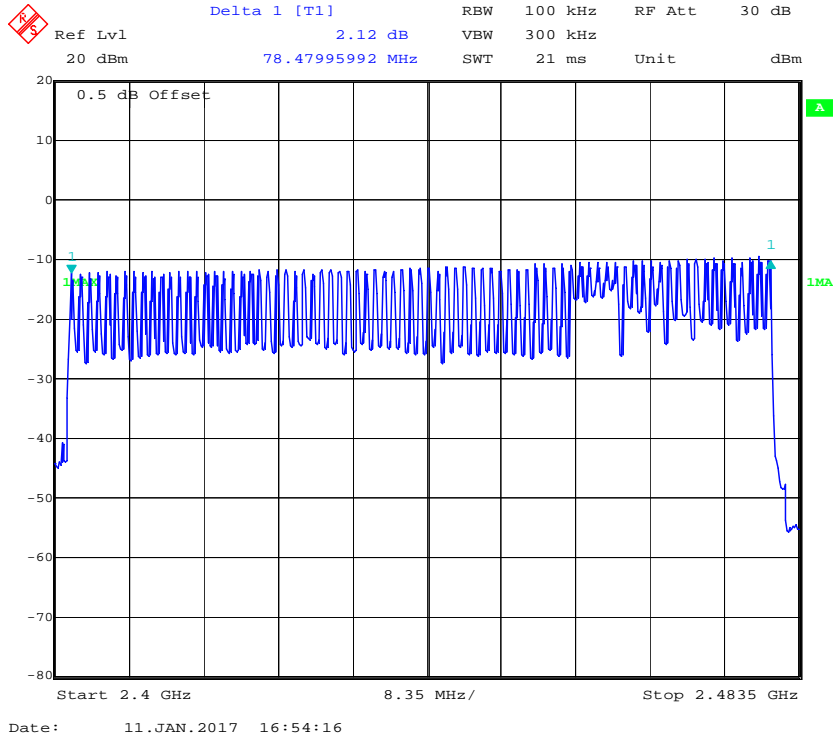
Please refer to following tables and plots

Test Mode: Transmitting

BDR Mode (GFSK):

Frequency Range (MHz)	Number of Hopping Channel	Limit
2400-2483.5	79	≥15

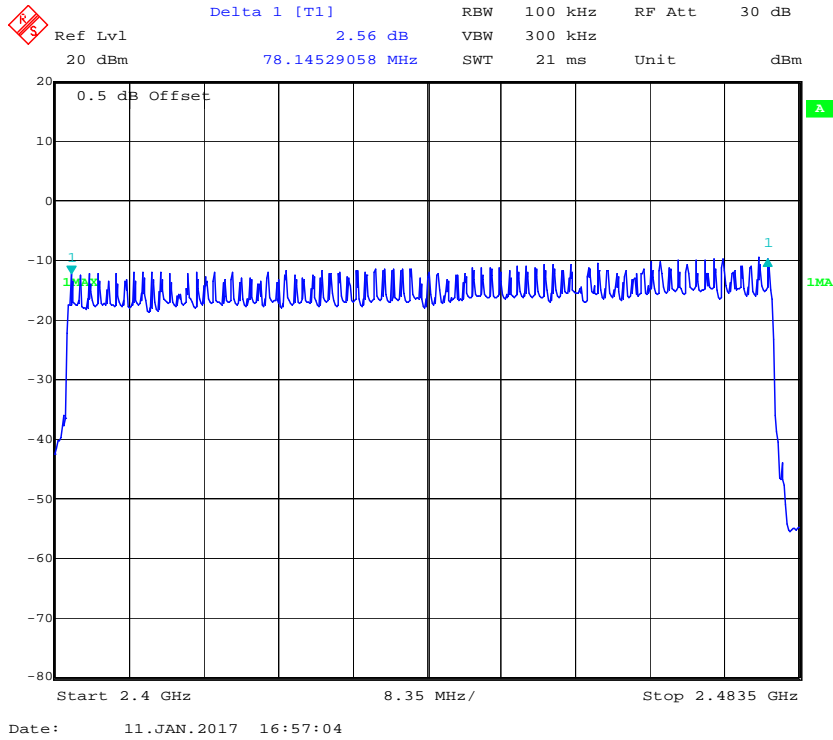
Number of Hopping Channels



EDR Mode ($\pi/4$ -DQPSK):

Frequency Range (MHz)	Number of Hopping Channel	Limit
2400-2483.5	79	≥ 15

Number of Hopping Channels



FCC §15.247(a) (1) (iii) - TIME OF OCCUPANCY (DWELL TIME)

Applicable Standard

Frequency hopping systems in the 2400-2483.5 MHz shall use at least 15 channels. The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed. Frequency hopping systems may avoid or suppress transmissions on a particular hopping frequency provided that a minimum of 15 channels are used.

Test Procedure

The EUT was worked in channel hopping; Spectrum SPAN was set as 0. Sweep was set as 0.4 * channel no. (s), the quantity of pulse was get from single sweep. In addition, the time of single pulses was tested.

Dwell Time= time slot length * hope rate/ number of hopping channels * 31.6s
Hop rate=1600/s

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Rohde & Schwarz	Signal Analyzer	FSIQ26	831929/005	2016-09-21	2017-09-20
N/A	RF Cable	N/A	N/A	Each Time	/

* **Statement of Traceability:** BAACL (Chengdu) attested that all calibrations have been performed, traceable to National Primary Standards and International System of Units (SI).

Test Data

Environmental Conditions

Temperature:	25.7 °C
Relative Humidity:	41 %
ATM Pressure:	95.6 kPa

* The testing was performed by Kevin Hu on 2017-01-11.

Test Result: Compliance.

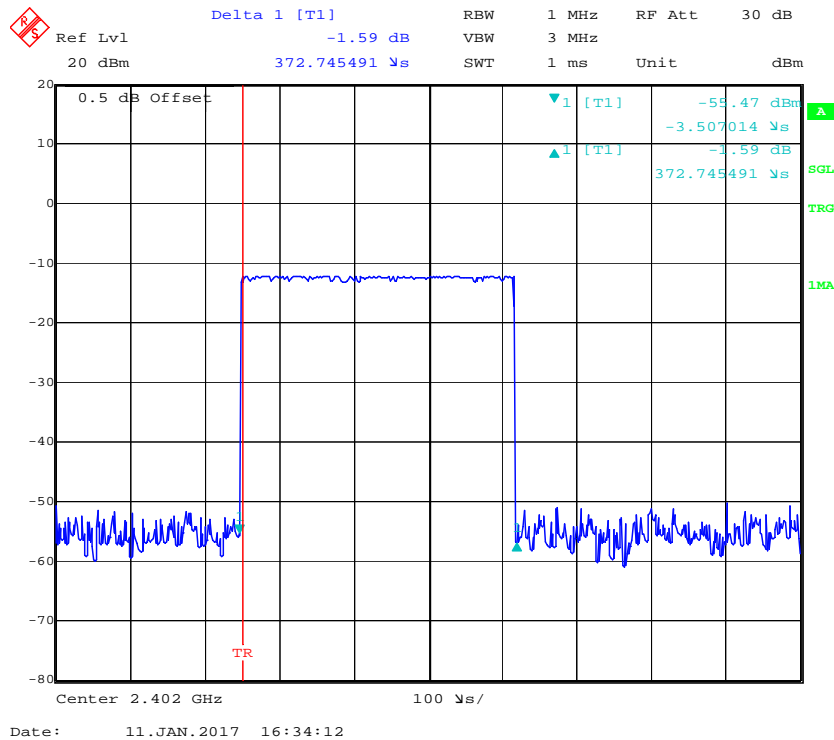
Please refer to following tables and plots

Test Mode: Transmitting

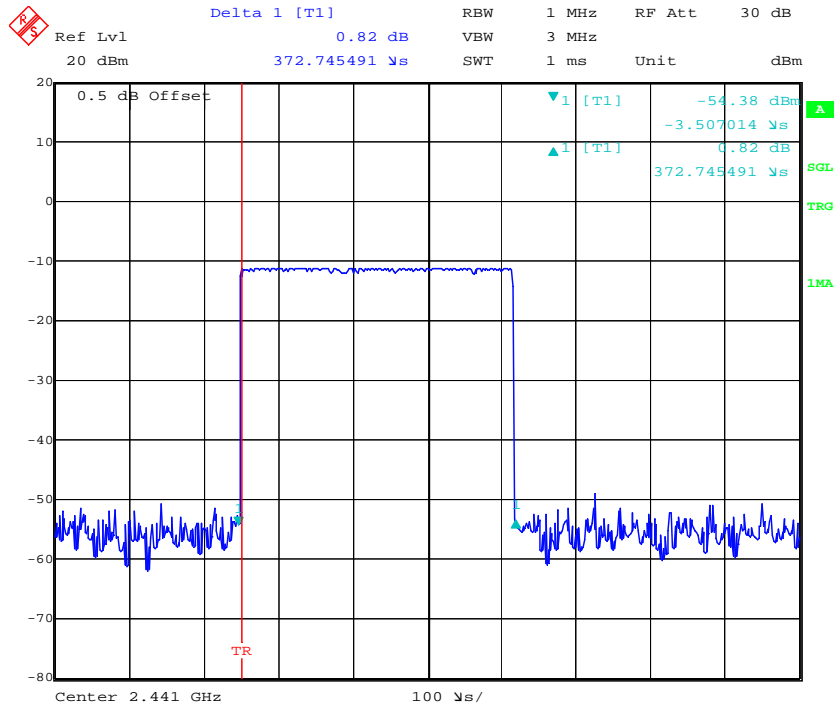
BDR Mode (GFSK):

Mode	Channel	Pulse Width (ms)	Dwell Time (s)	Limit (s)	Result
DH1	Low	0.373	0.1193	0.4	Compliance
	Middle	0.373	0.1193	0.4	Compliance
	High	0.373	0.1193	0.4	Compliance
	Note: Dwell time=Pulse time (ms) × (1600/2/79) ×31.6 s				
DH3	Low	1.639	0.2623	0.4	Compliance
	Middle	1.639	0.2623	0.4	Compliance
	High	1.639	0.2623	0.4	Compliance
	Note: Dwell time=Pulse time (ms) × (1600/4/79) ×31.6 s				
DH5	Low	2.898	0.3091	0.4	Compliance
	Middle	2.908	0.3102	0.4	Compliance
	High	2.898	0.3091	0.4	Compliance
	Note: Dwell time=Pulse time (ms) × (1600/6/79) ×31.6 s				

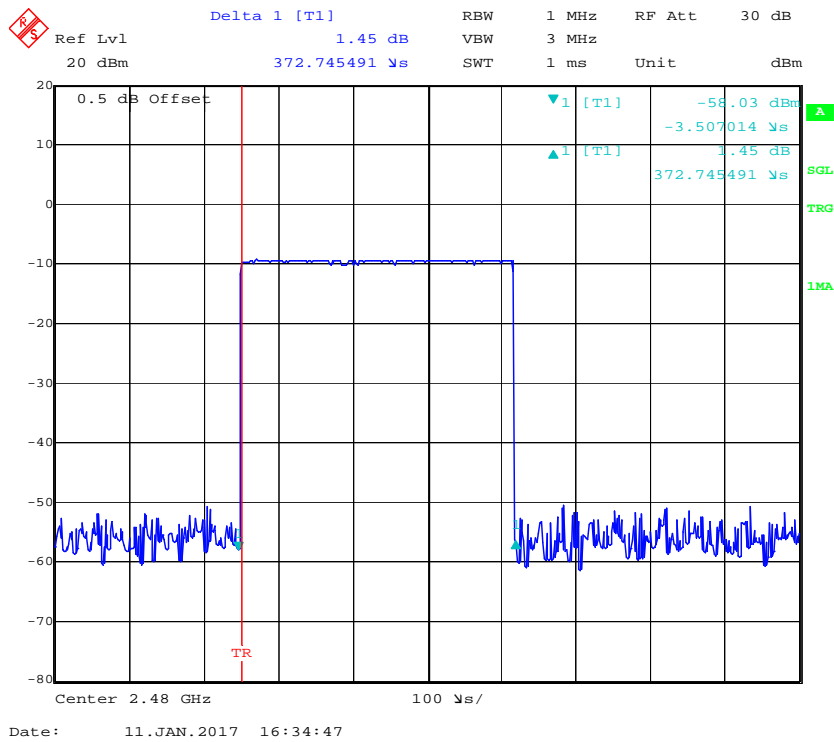
DH1: Low Channel



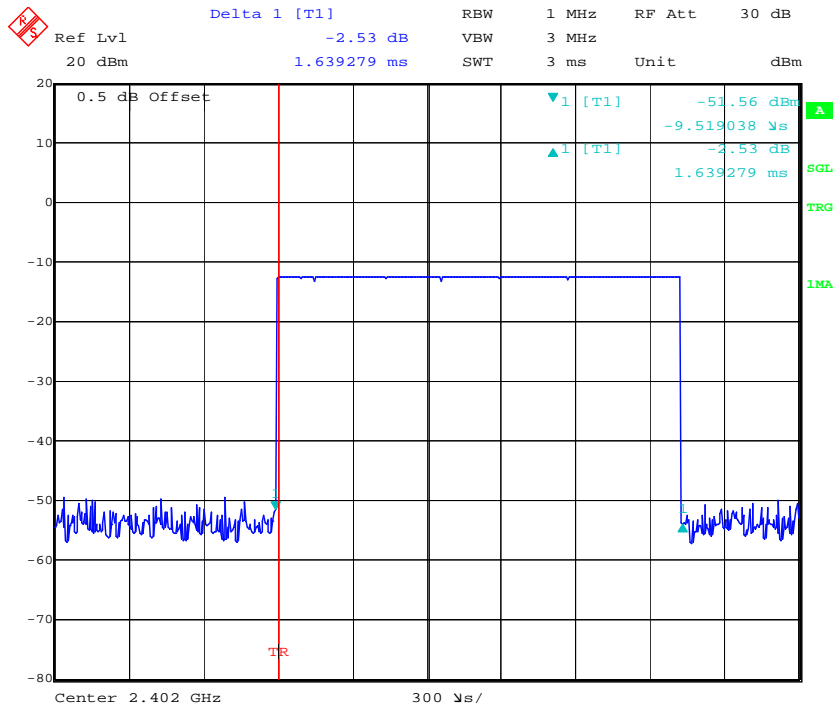
DH1: Middle Channel



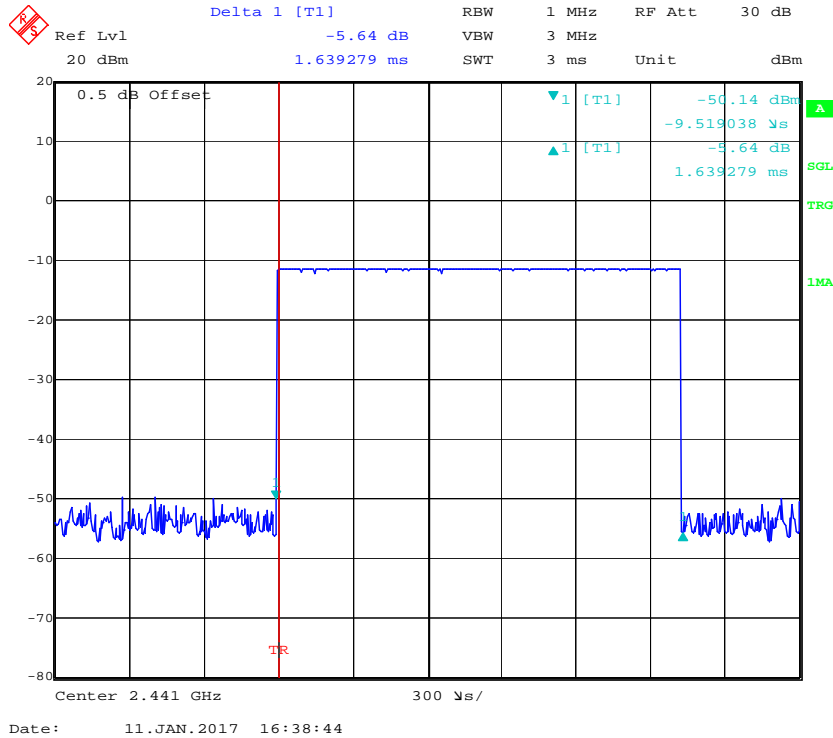
DH1: High Channel



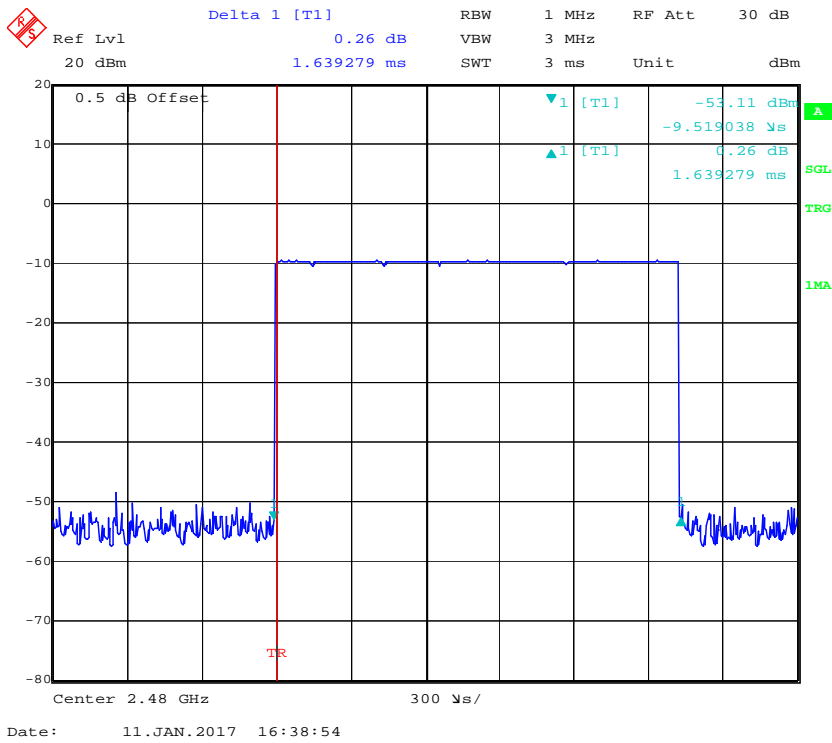
DH3: Low Channel



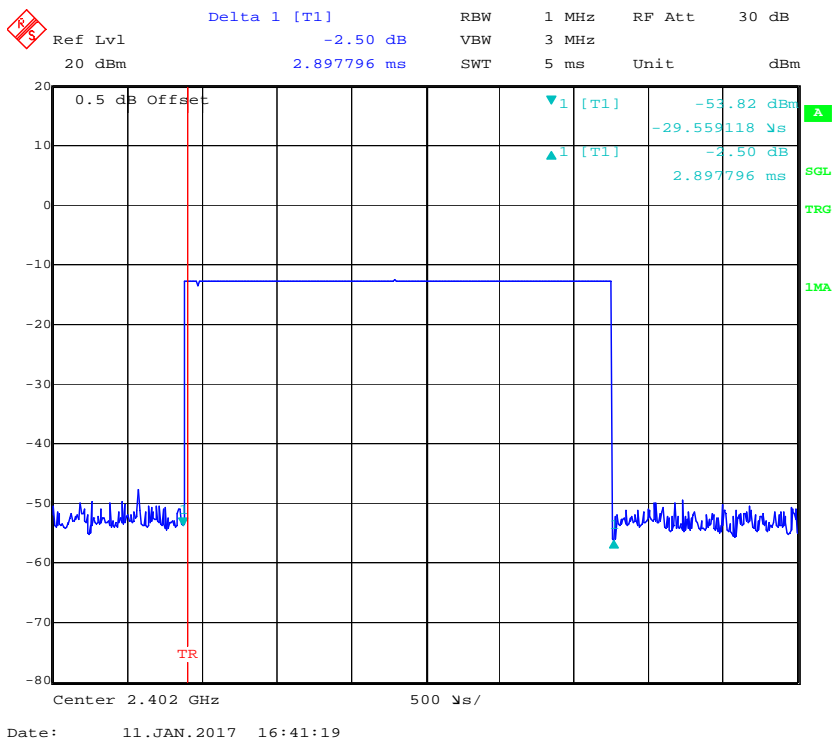
DH3: Middle Channel



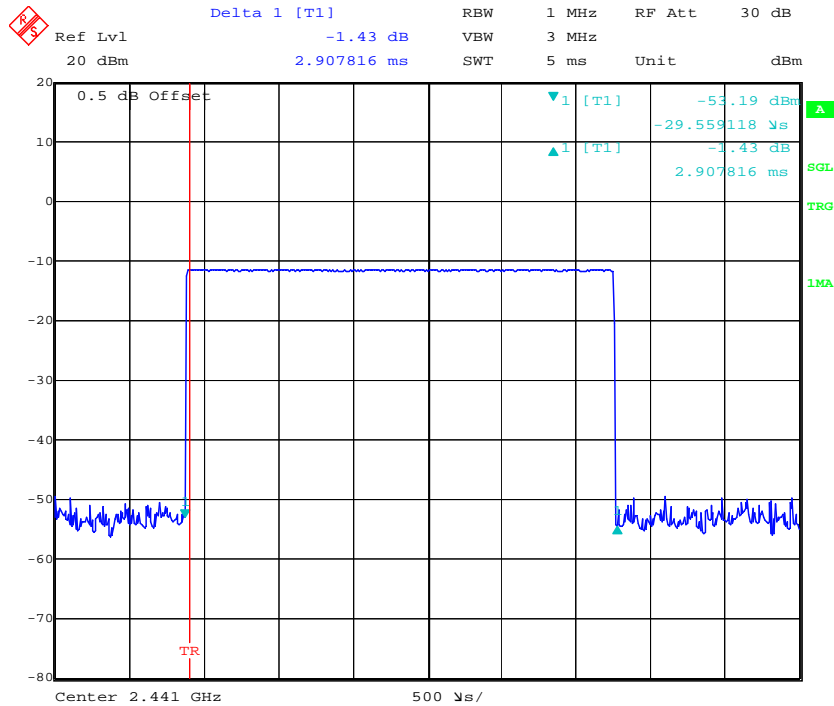
DH3: High Channel



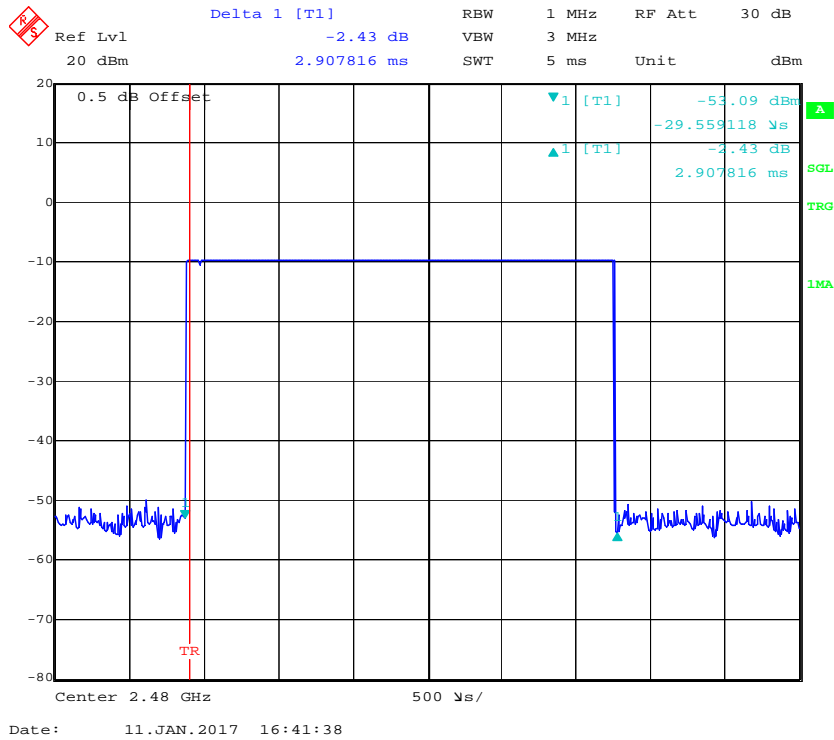
DH5: Low Channel



DH5: Middle Channel



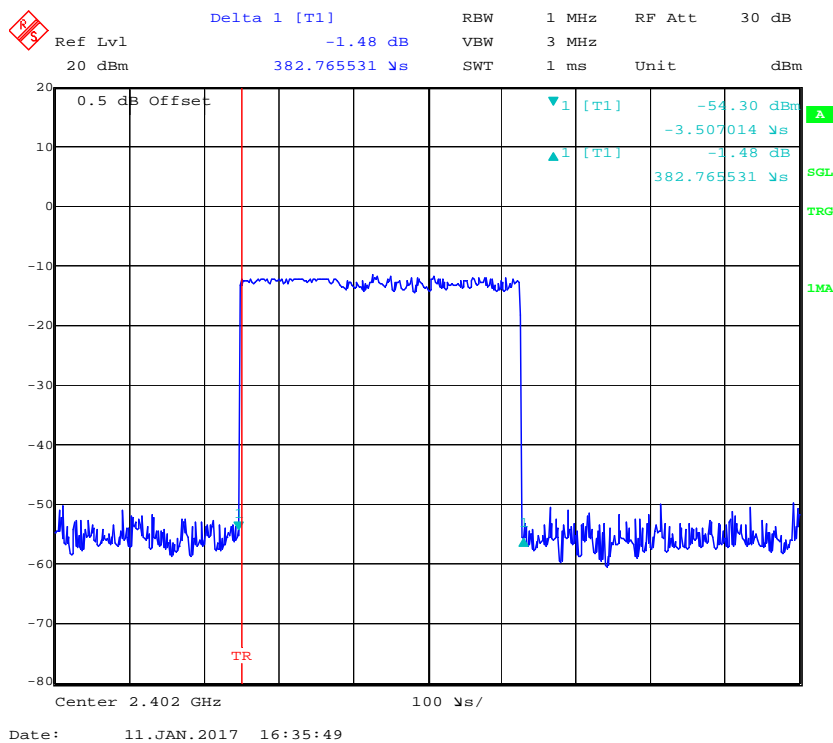
DH5: High Channel



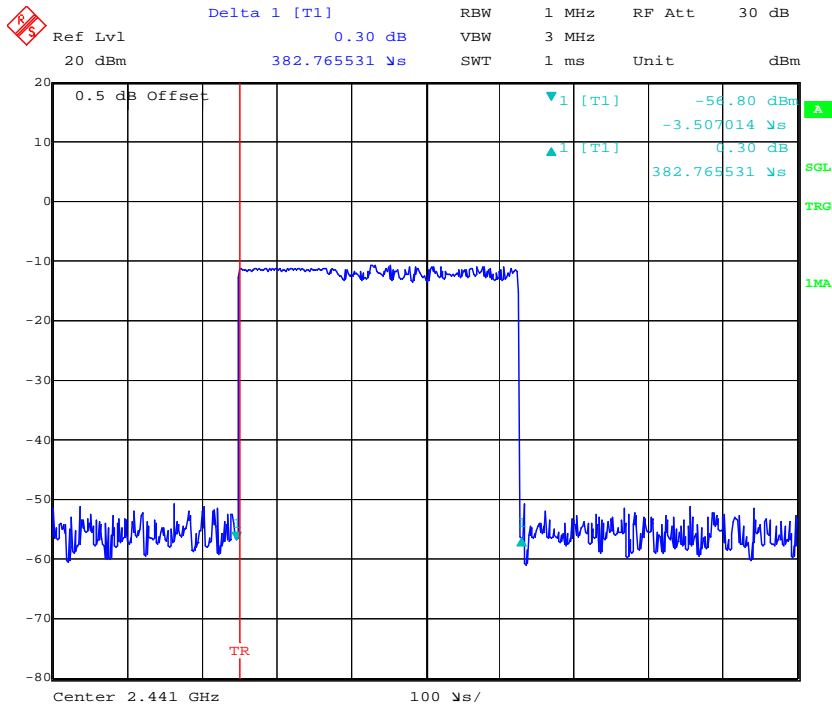
EDR Mode ($\pi/4$ -DQPSK):

Mode	Channel	Pulse Width (ms)	Dwell Time (s)	Limit (s)	Result
2DH1	Low	0.383	0.1225	0.4	Compliance
	Middle	0.383	0.1225	0.4	Compliance
	High	0.383	0.1225	0.4	Compliance
	Note: Dwell time=Pulse time (ms) × (1600/2/79) ×31.6 s				
2DH3	Low	1.645	0.2632	0.4	Compliance
	Middle	1.645	0.2632	0.4	Compliance
	High	1.645	0.2632	0.4	Compliance
	Note: Dwell time=Pulse time (ms) × (1600/4/79) ×31.6 s				
2DH5	Low	2.898	0.3091	0.4	Compliance
	Middle	2.908	0.3102	0.4	Compliance
	High	2.908	0.3102	0.4	Compliance
	Note: Dwell time=Pulse time (ms) × (1600/6/79) ×31.6 s				

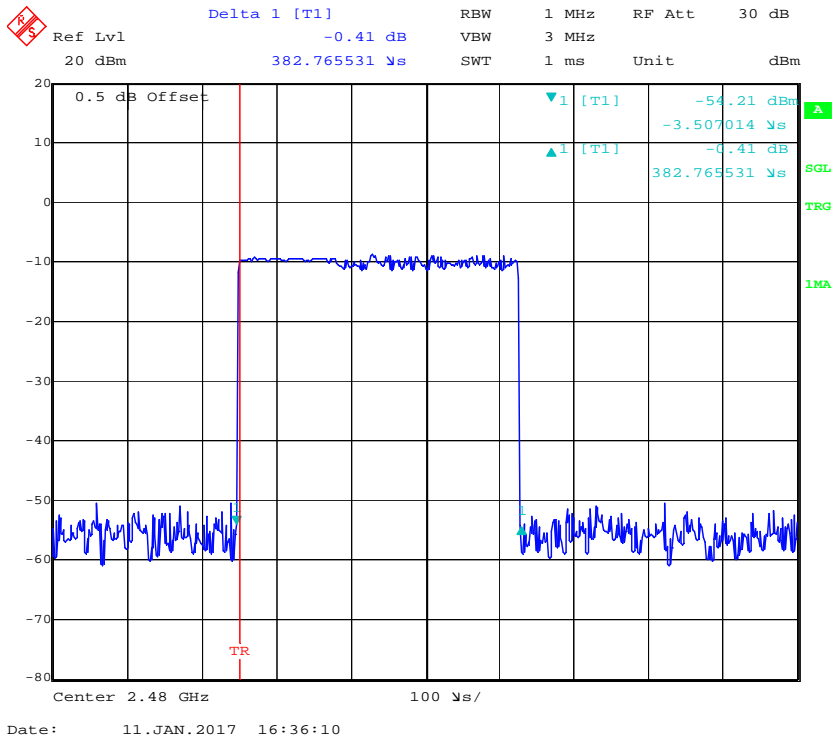
2DH1: Low Channel



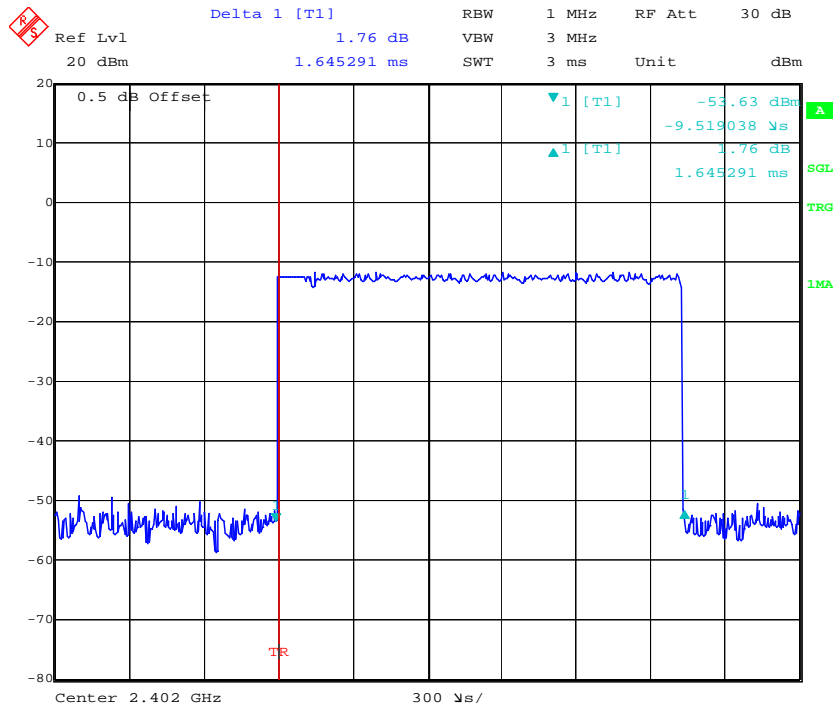
2DH1: Middle Channel



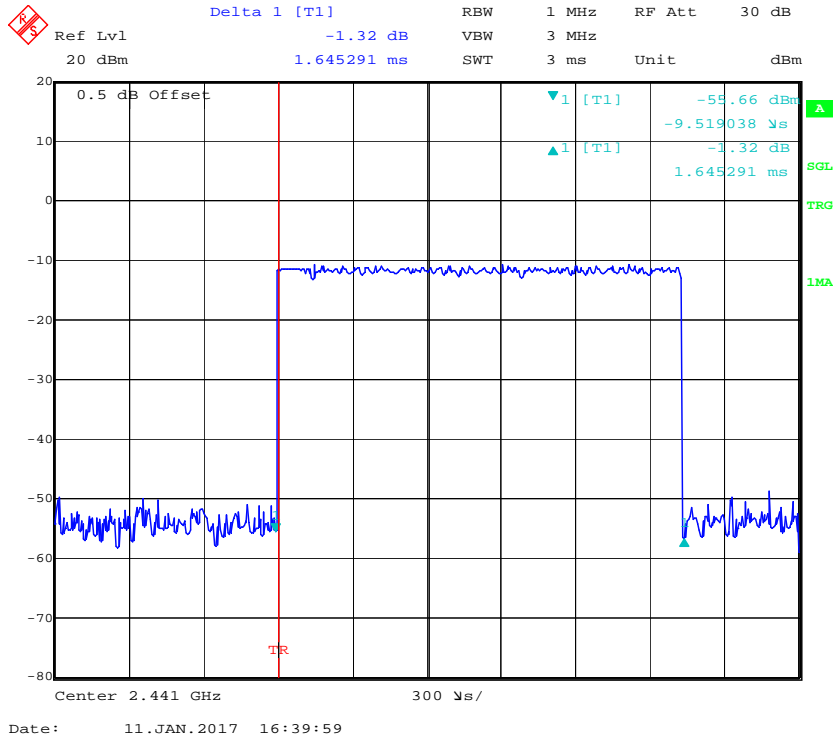
2DH1: High Channel



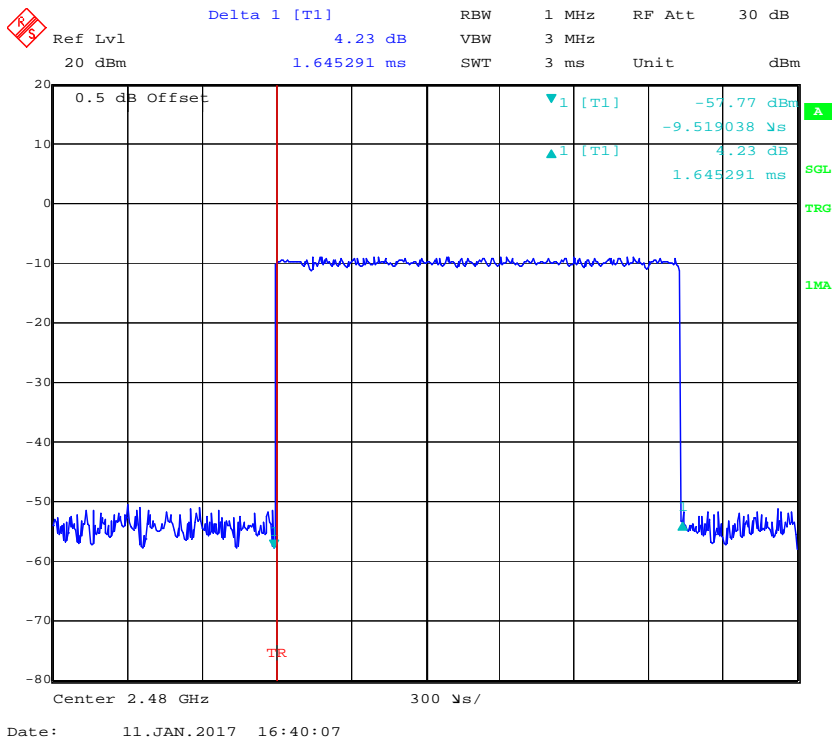
2DH3: Low Channel



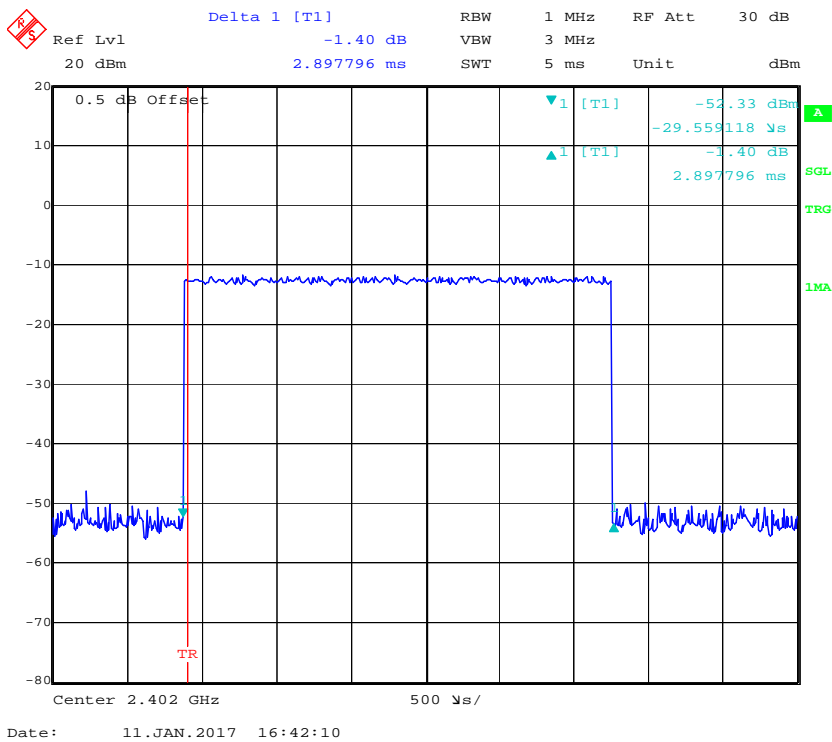
2DH3: Middle Channel



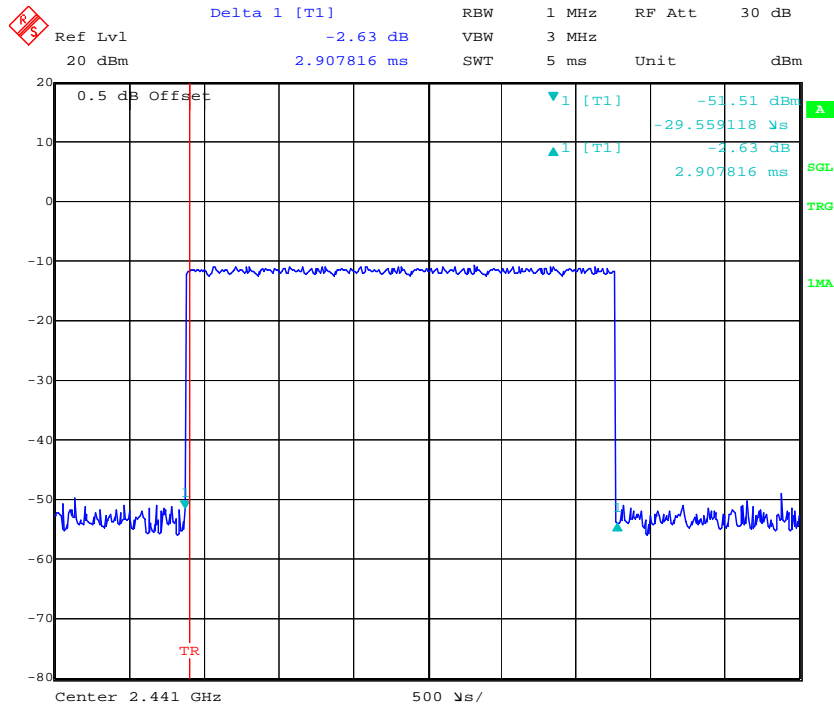
2DH3: High Channel



2DH5: Low Channel

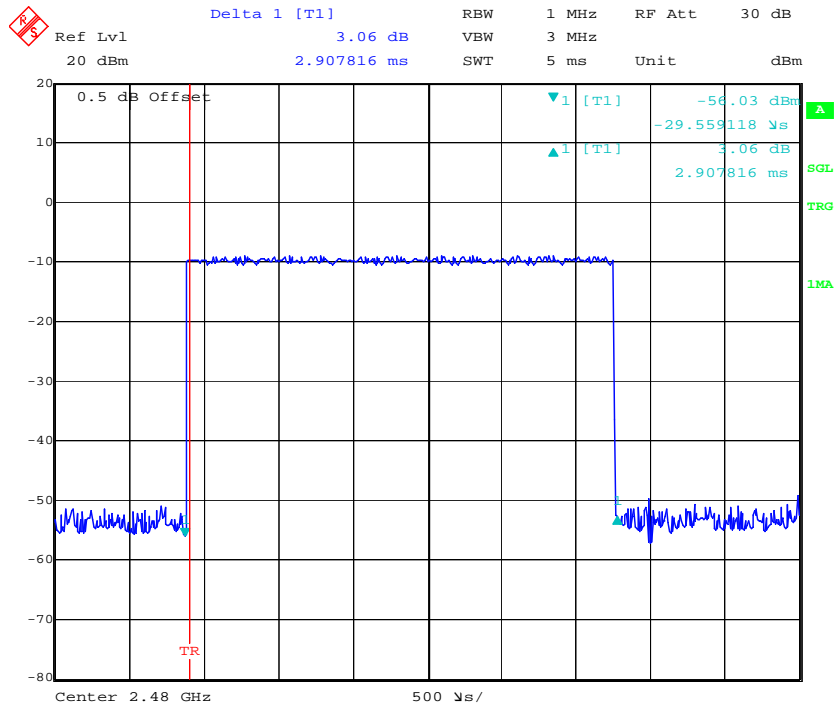


2DH5: Middle Channel



Date: 11.JAN.2017 16:42:20

2DH5: High Channel



Date: 11.JAN.2017 16:42:30

FCC §15.247(b) (1) - PEAK OUTPUT POWER MEASUREMENT

Applicable Standard

According to §15.247(b) (1), for frequency hopping systems operating in the 2400–2483.5 MHz band employing at least 75 non-overlapping hopping channels, and all frequency hopping systems in the 5725-5850 MHz band: 1 watt. For all other frequency hopping systems in the 2400–2483.5 MHz band: 0.125 watts

Test Procedure

1. Place the EUT on a bench and set in transmitting mode.
2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to one test equipment.
3. Add a correction factor to the display.

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Rohde & Schwarz	Signal Analyzer	FSIQ26	831929/005	2016-09-21	2017-09-20
N/A	RF Cable	N/A	N/A	Each Time	/

* **Statement of Traceability:** BAAC (Chengdu) attested that all calibrations have been performed, traceable to National Primary Standards and International System of Units (SI).

Test Data

Environmental Conditions

Temperature:	25.7 °C
Relative Humidity:	41 %
ATM Pressure:	95.6 kPa

* The testing was performed by Kevin Hu on 2017-01-11.

Test Result: Compliance.

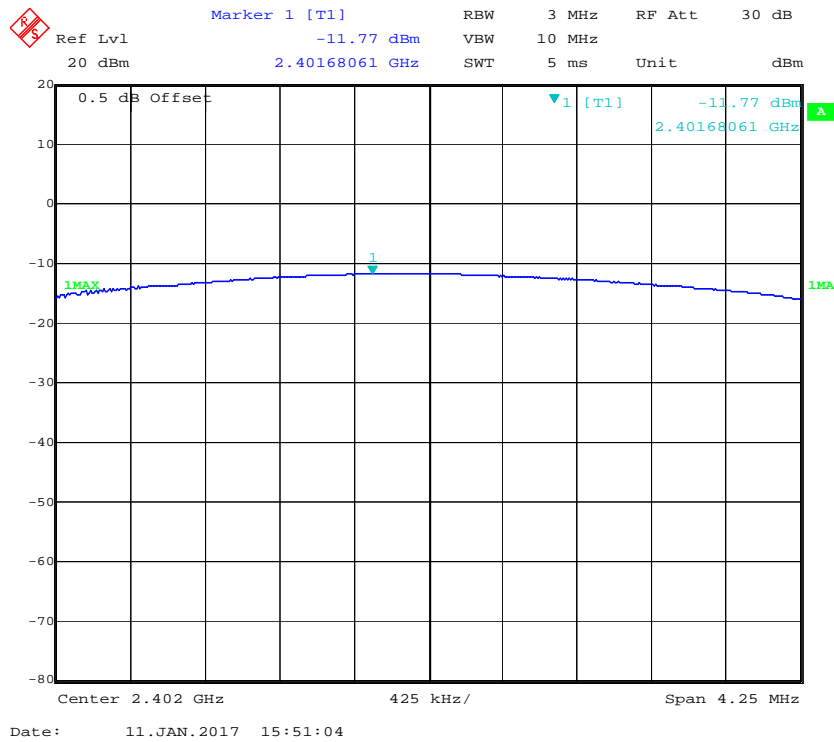
Test Mode: Transmitting

Mode	Channel	Frequency (MHz)	Output power (dBm)	Limit (dBm)
BDR Mode (GFSK)	Low	2402	-11.77	30
	Middle	2441	-10.64	30
	High	2480	-9.31	30
EDR Mode ($\pi/4$ -DQPSK)	Low	2402	-11.03	30
	Middle	2441	-9.71	30
	High	2480	-8.25	30

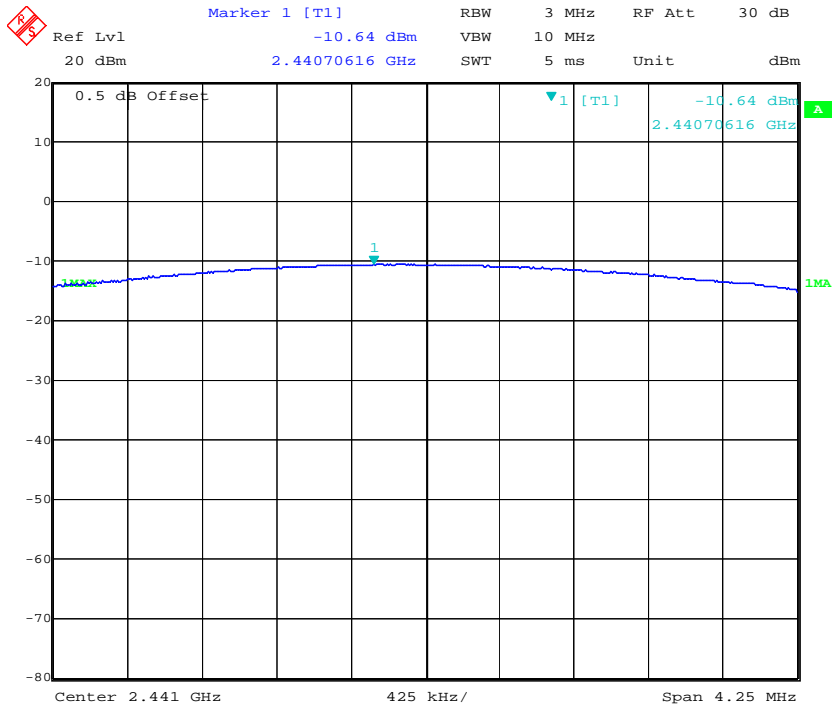
Note: The data above was tested in conducted mode.

BDR Mode (GFSK):

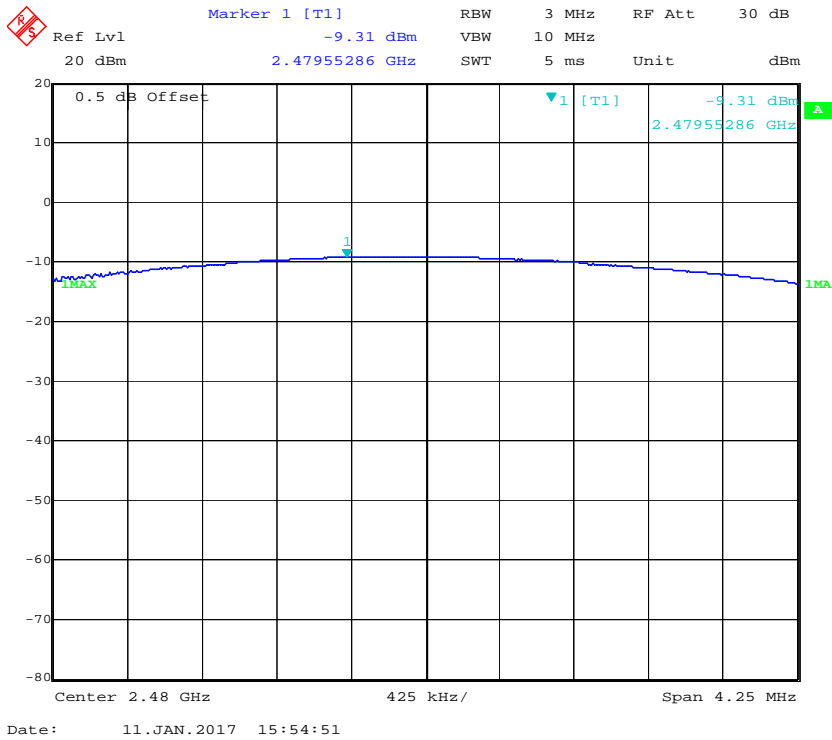
Output Power, Low Channel



Output Power, Middle Channel

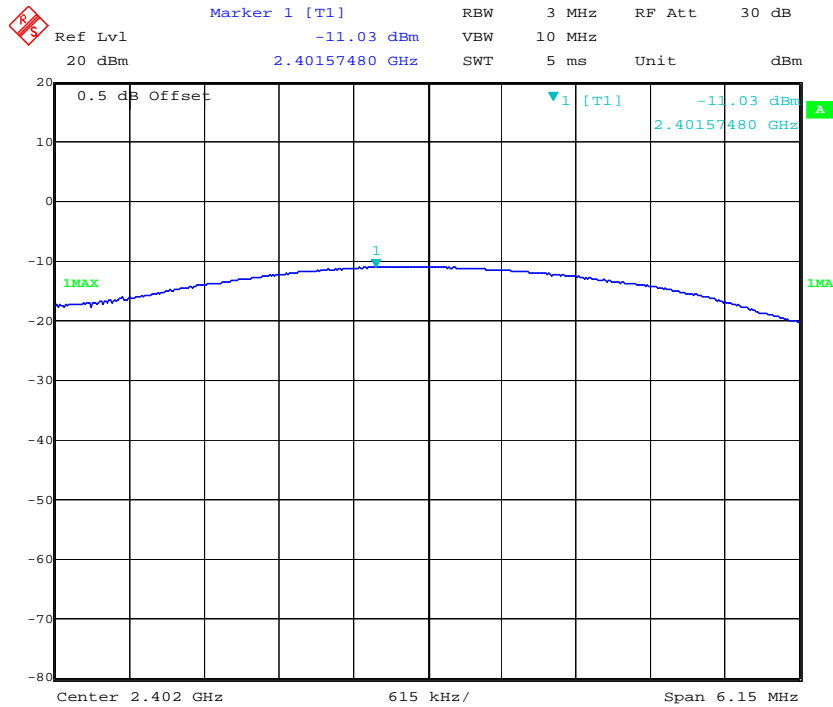


Output Power, High Channel



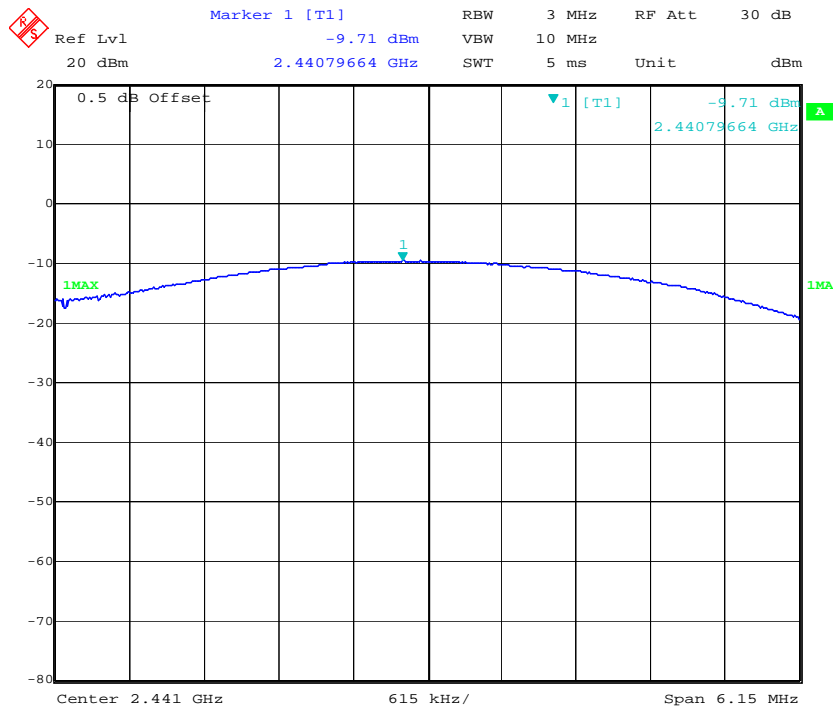
EDR Mode ($\pi/4$ -DQPSK):

Output Power, Low Channel



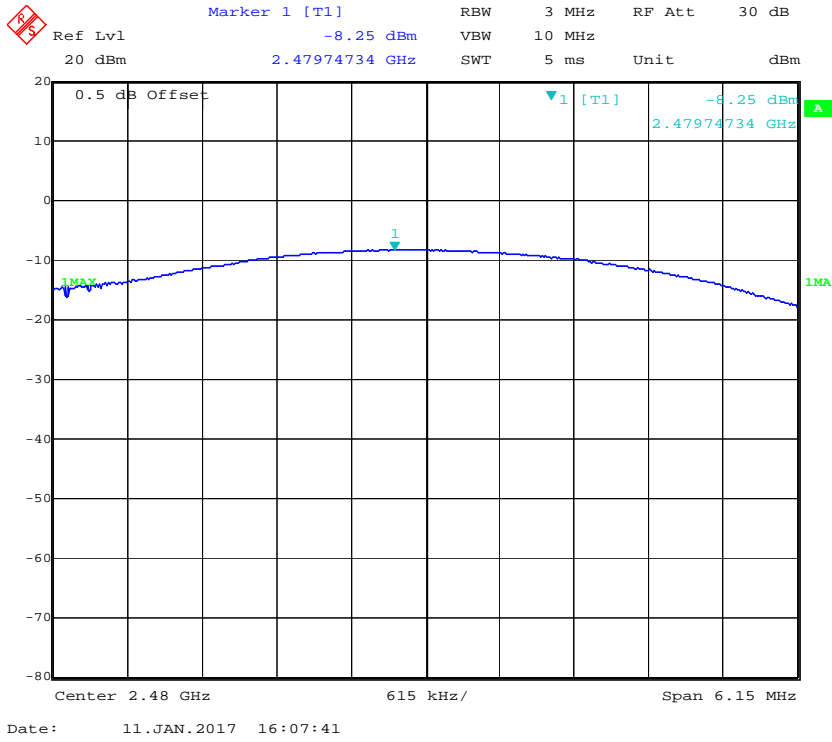
Date: 11.JAN.2017 16:04:26

Output Power, Middle Channel



Date: 11.JAN.2017 16:06:21

Output Power, High Channel



FCC §15.247(d) - BAND EDGES TESTING

Applicable Standard

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

Test Procedure

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Remove the antenna from the EUT and then connect to a low loss RF cable from the antenna port to a EMI test receiver, then turn on the EUT and make it operate in transmitting mode. Then set it to Low Channel and High Channel within its operating range, and make sure the instrument is operated in its linear range.
3. Set both RBW and VBW of spectrum analyzer to 100 kHz with a convenient frequency span including 100 kHz bandwidth from band edge.
4. Measure the highest amplitude appearing on spectral display and set it as a reference level. Plot the graph with marking the highest point and edge frequency.
5. Repeat above procedures until all measured frequencies were complete.

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Rohde & Schwarz	Signal Analyzer	FSIQ26	831929/005	2016-09-21	2017-09-20
N/A	RF Cable	N/A	N/A	Each Time	/

* **Statement of Traceability:** BACL (Chengdu) attested that all calibrations have been performed, traceable to National Primary Standards and International System of Units (SI).

Test Data

Environmental Conditions

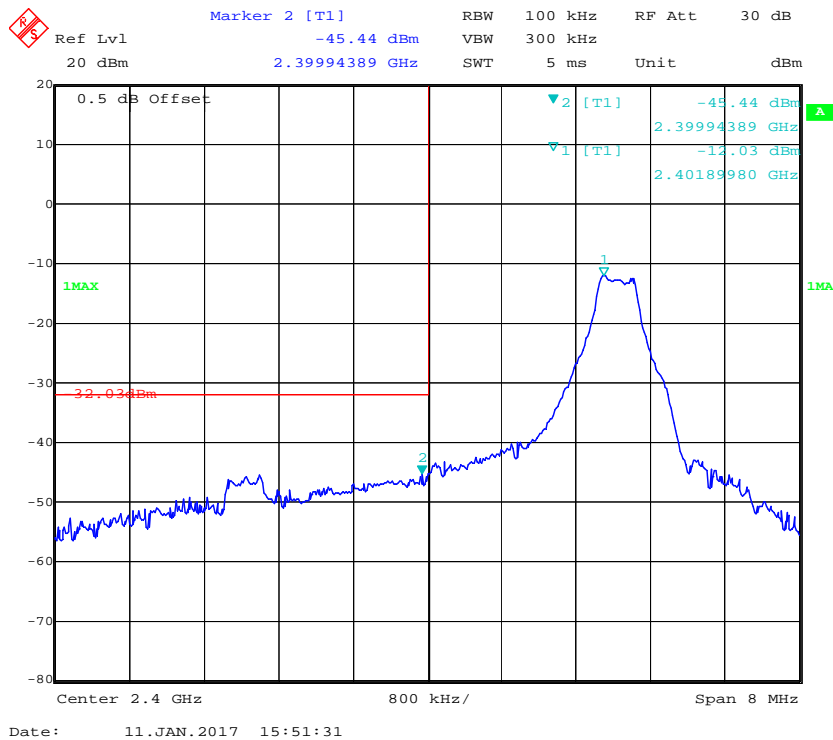
Temperature:	25.7 °C
Relative Humidity:	41 %
ATM Pressure:	95.6 kPa

* The testing was performed by Kevin Hu on 2017-01-11.

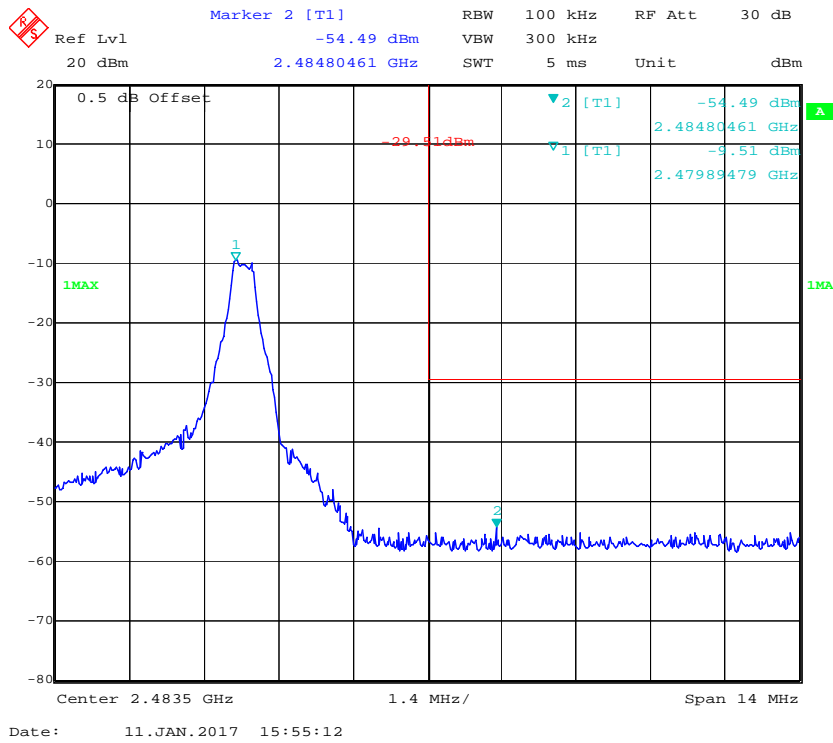
Test Result: Compliance

BDR Mode (GFSK):

Band Edge, Left Side

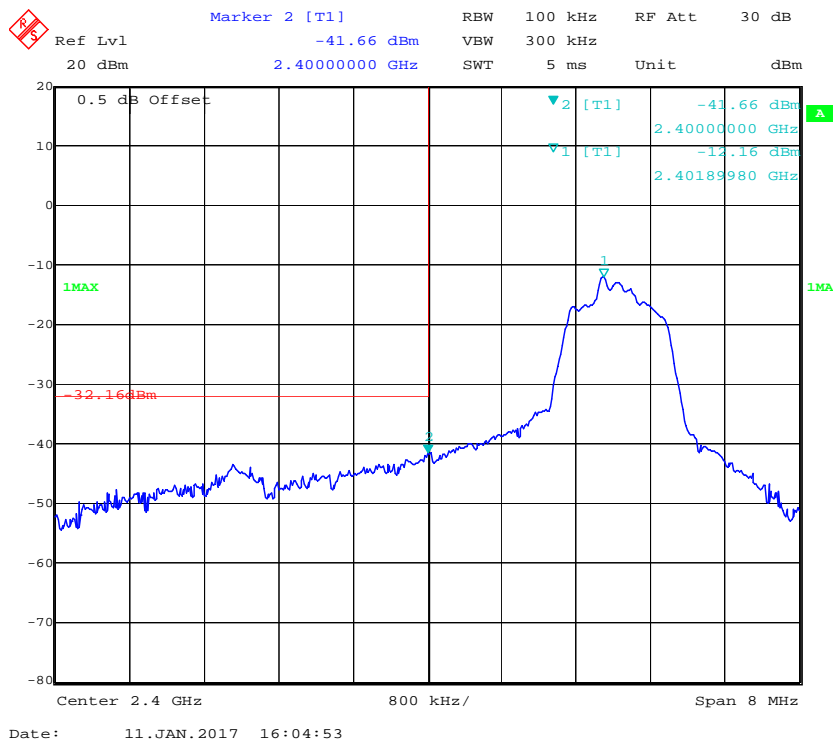


Band Edge, Right Side

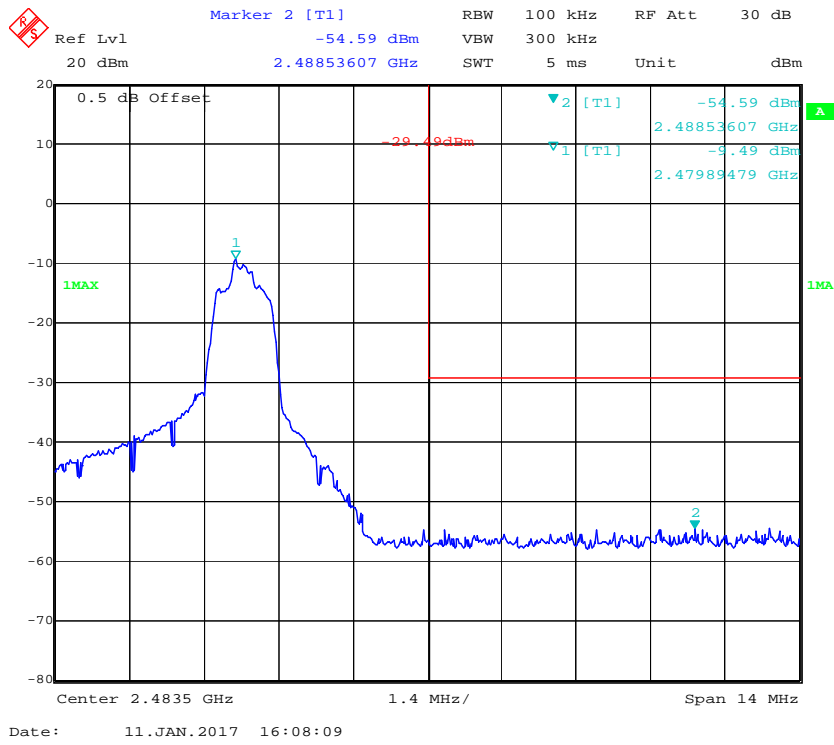


EDR Mode ($\pi/4$ -DQPSK):

Band Edge, Left Side



Band Edge, Right Side



*****END OF REPORT*****